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THE WILSON BULLETIN
A QUARTERLY MAGAZINE OF ORNITHOLOGY
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PRODUCTION OF THE REDHEAD (*NYROCA AMERICANA*) IN IOWA[1]

BY JESSOP B. LOW

NESTING of waterfowl on the outer edges of breeding ranges has not in the past received as much attention from game administrators as that in the central or optimum portions of the same breeding ranges. Because of certain conditions, both known and unknown, the peripheries of breeding ranges do not provide the most favorable conditions for nesting waterfowl. However, as management practices bring existing optimum breeding grounds near the limit of production, other areas of lower productive capacities must be recognized and brought under management. We realized at the inception of this investigation that Iowa marshes and lakes lay on the southern boundary of the Redhead breeding range and that we could not expect such nesting concentrations of ducks as have been reported from areas like the Lower Souris Refuge, North Dakota (Kalmbach, 1938) and the Bear River Refuge, Utah (Williams and Marshall, 1938).

This investigation had a two fold objective: (1) to ascertain the degree to which Redheads nested in Iowa, and (2) to make a nesting study of those Redheads breeding in Iowa. A definite unit area was chosen on which to carry out the nesting investigation, and an intensive search was made on this area for nests. The intensive search within a given area, although limiting the number of nests brought under observation, permitted a thorough investigation of all the available plant cover types, a procedure ordinarily not possible in the extensive search method.

The data for this paper were gathered during the spring and summer of 1938 as part of the waterfowl program of the Iowa Cooperative Wildlife Research Unit under the direction of Dr. George O. Hendrickson, Iowa State College, and Thomas G. Scott, U.S. Biological Survey. The investigation centered in northwest Iowa in the vicinity of Lost Island Lake, Clay and Palo Alto counties. Within a radius of five miles of Lost Island Lake lie six lakes and numerous marshes and

[1] Journal paper No. J-747 of the Iowa Agricultural Experiment Station, Ames, Iowa. Project 496. Iowa State College, Iowa Conservation Commission, and the U. S. Bureau of Biological Survey cooperating with the American Wildlife Institute.

sloughs constituting the largest remnant of duck breeding grounds now found in Iowa.

Nesting Habits

In contrast to the dry ground nesting habits of the puddle ducks in general and of many of the diving ducks, the nesting of the Redhead in Iowa is confined exclusively to stands of emergent vegetation within the shallow-water lakes and marshes. The nesting data for this paper were secured while wading or pushing a small boat through the marshes and sloughs. A periodic and methodic search was made of the nesting habitats during the months of May, June, and July to locate nests and to take data on nests already under observation. During the 1938 nesting season 42 nests were observed. In the five-year period of 1933 to 1937 Bennett (1938a) obtained data on 22 Redhead nests incidental to other work in this marsh area of Clay and Palo Alto counties. Two other nesting investigations in which the Redhead was considered were on the Bear River Refuge, Utah (Williams and Marshall, 1938), and on the Prince Albert district, central Saskatchewan (Furniss, 1938).

The nesting data on the Redhead in Clay and Palo Alto counties for the 1938 season were presented in Table 1. The height of the nest-building and egg-laying period was June 19 to 25, during which period one-third of the total nests observed were constructed. Of the 42 Redhead nests 23 (54.74 per cent) successfully produced young, and 19 (45.26 per cent) were unsuccessfully terminated. This nesting success for the Redhead is 13 per cent above that given earlier by Bennett (1938a). Kalmbach (1939) recorded the average nesting success of waterfowl as 60 per cent, which is 6 per cent above that obtained in this investigation of the Redhead.

Sixty-eight days (May 10 to July 16) elapsed from the time the first nest was located until eggs in the last nest under observation hatched. However, the first nest located contained 10 eggs, which at the rate of one egg a day indicated May 1 or earlier as the date on which egg-laying was begun. Bennett (1938a) reported a 59-day inclusive nesting season for the 22 nests under his observation. There were 384 eggs in 39 of the 42 nests under observation. The clutches averaged 9.85 eggs to a nest. Williams and Marshall (1938) found an average of 12.5 eggs to a clutch in Utah, while Furniss (1938) reported an average clutch of 9.33 eggs in Saskatchewan. Bent (1923) concluded that the Redhead deposits between 10 and 15 eggs in a clutch. There was a gradual tapering off in the number of eggs to a clutch as the end of the season approached. A total of 38.29 per cent (147 eggs) of the eggs hatched.

The size of the individual clutches appeared to have a definite relationship to the success and failure of the clutches. A greater per-

centage of smaller than larger clutches terminated successfully. This fact was borne out particularly by observations during periods of rapid rise in water level which showed that the larger clutches of eggs were not raised as rapidly as smaller clutches through the placing of new nesting materials under them by the female. It appeared probable that some of the smaller clutches were re-nesting attempts, since they were more prevalent later in the season; however, from data at hand this cannot be definitely shown. Smaller clutches toward the end of

Figure 1. Redhead nesting cover in Mud Lake, Clay County, Iowa. Hardstem bulrush is shown in the background; cattail, giant bur reed, sweet flag, and sedges in the foreground.

the nesting season indicative of re-nesting were also noted in the Blue-winged Teal (*Querquedula discors*) (Bennett, 1938b), in the Ring-necked Pheasant (*Phasianus colchicus torquatus*) (Errington and Hamerstrom, 1937), and in many other species.

The hatching period of the Redhead extended over 45 days (June 2 to July 16). The week in which most hatching took place was July 10 to 16, which was approximately 4 weeks after the period of heaviest

egg-laying (June 19 to 25). Bent (1923) recorded 22, 23, or 24 days as the incubation period of the Redhead.

Failure of eggs to hatch was attributed to the following causes: (1) destruction by flooding from heavy rain storms, (2) desertion, (3) the female leaving the nest before all the eggs had hatched, (4) infertility, and (5) predation. The instability of the water levels in the nesting habitats was the most destructive factor in 1938. Ten (52.6 per cent) of the 19 unsuccessful nests were flooded. Two very severe rain storms during the latter part of June raised the water in the lakes and sloughs 6 to 24 inches, depending on the size of the territory drained by the lakes and sloughs.

Nest desertion by the Redheads was relatively high. Eight nests (19.04 per cent) were deserted. The greatest single factor contributing to nest desertion was the deposition of eggs by several Redhead females in one nest. These compound sets were made at the beginning of the nesting season, presumably before some of the females had constructed their own nests. Although the nests of the 4 compound sets were well constructed and well filled with eggs, none were incubated. One other nest was deserted several weeks before it was located. One deserted nest containing one egg may have been abandoned as a result of human interference at too early a period in the history of the nest. Redheads under observation were fairly tolerant of human trespassing on the nesting habitat. Visits were made to some nest sites as many as six times for purposes of observation, and during the study no desertion from such interference was detected with the possible exception of the one nest cited above. It should be mentioned, however, that all possible precautions were taken to avoid any drastic disturbances that would give reason for desertion.

Another factor in the desertion of nests appeared to be the intolerance of the Redhead female of the Ruddy Duck (*Erismatura jamaicensis rubida*) and Mallard (*Anas platyrhynchos platyrhynchos*) eggs which were deposited in the Redhead nests. Ruddy Duck eggs were removed from 5 Redhead nests, presumably by the female Redhead. However, in 2 other Redhead nests Ruddy Duck and Mallard eggs were incubated with the Redhead eggs. None of these parasite eggs hatched, probably because of the difference in time in which the incubation of the eggs began.

Redheads, in common with other water birds, deposit their eggs in other birds' nests, including those of the Ruddy Duck, American Coot (*Fulica americana americana*), and the American Bittern (*Botaurus lentiginosus*). Two Redhead eggs deposited in an American Bittern nest hatched, but the young died soon after hatching.

When once begun, the egg-laying usually continued rather uniformly until incubation of the clutch started. In some nests, however, additional eggs were deposited from one to several days after incuba-

tion began, with the result that often the last deposited eggs were deserted in the nests when the female ducks left the nests with the juveniles which were first hatched. Occasionally eggs were deposited in nests after incubation had proceeded two or three weeks. In some cases it may have been the owners of the nests that laid additional eggs shortly after incubation began, but much later additions to the clutch were probably laid by other ducks. The length of time the embryo remained alive after incubation stopped apparently depended upon the stage of development of the embryo and upon weather conditions. By macroscopic examination of the eggs it was determined that some embryos were alive as long as four days after the female had left the nest. Of the total of 47 eggs left in the nests after the female Redheads had departed with their juveniles, 30 (64 per cent) contained either living or dead embryos.

Infertile eggs did not appear to be a matter of earliness or lateness in the nesting season. Seventeen eggs (4.42 per cent) from 9 nests were infertile. Evidence of eggs laid promiscuously before the nesting season began, as reported in the case of the Blue-winged Teal (Bennett, 1938b), was not observed in this study of the Redhead.

Considerable predation on nests and juveniles has been reported in waterfowl studies in some parts of the country (Kalmbach, 1938). Very little predation occurred on the Redhead nests and juveniles of the marsh area under study in 1938. The choice of nesting habitat of the Redhead in a large degree rendered the Redhead populations inaccessible to the common terrestrial predators. As discussed later in more detail, the nests of the Redhead were constructed above the water in emergent vegetation, and as a result the only predation possible was from bird and swimming predators. Of the former, the Eastern Crow (*Corvus brachyrhynchos brachyrhynchos*) was the most abundant bird predator, although the Marsh Hawk (*Circus hudsonius*) and the Great Horned Owl (*Bubo virginianus virginianus*) were also present. Errington and Breckenridge (1936) found the remains of only one duck, probably a young Blue-winged Teal, in 557 food items of the Marsh Hawk in the Ruthven, Iowa, area. Mink (*Mustela vison*) and the snapping turtle (*Chelydra serpentina*) were the only swimming predators capable of reaching the nests or juveniles of the Redhead. Question has arisen as to the possible predation habits of the muskrat (*Ondatra zibethica*) on the Redhead, but so far we have found no evidence of it. Pond turtles (*Chrysemys picta*) observed resting on Redhead nests did not molest the eggs or nests. In addition, mammal predators frequenting the land adjoining the marshes and potholes were the northern plains red fox (*Vulpes regalis*), common badger (*Taxidea taxus taxus*), long-tailed weasel (*Mustela frenata spadix*), prairie spotted skunk (*Spilogale interrupta*), striped skunk (*Mephitis*

mephitis), the domestic dog (*Canis familiaris*) and the domestic cat (*Felis domestica*).

Nesting Cover

The nesting cover of the Redhead in northwest Iowa was composed principally of hardstem bulrush (*Scirpus acutus*), river-bank sedge (*Carex riparia*) and cattail (*Typha* sp.). The preferred habitat consisted of emergent vegetation in the proportion of 40 per cent hardstem bulrush, 33 per cent river-bank sedge, and a number of minor plants comprising the remainder. Approximately 10 per cent of the total water acreage of the better habitat was free of emergent vegetation. More important among the minor plants were reed (*Phragmites communis*), giant bur reed (*Sparganium eurycarpum*), sweet flag

Figure 2. Redhead young one hour after hatching. Nest constructed of hardstem bulrush.

(*Acorus calamus*), river bulrush (*Scirpus fluviatilis*), smartweed (*Polygonum* sp.), arrowhead (*Sagittaria latifolia*), giant bulrush (*Scirpus validus*), and slender bulrush (*Scirpus heterochaetus*).

Thirty-eight per cent of the nests were located in stands of vegetation composed of both hardstem bulrush and river-bank sedge. These two plant species, composing over 70 per cent of the nesting cover,

held 60 per cent of the nests. The importance of the hardstem bulrush to nesting Redheads is further attested by the findings of Williams and Marshall (1938) in which 65 per cent of the Redhead nests on the Bear River marshes, Utah, were located in this type of vegetation.

Nest Construction

The Redhead nests were constructed in the emergent vegetation out in the water, and the eggs were maintained, in most instances, a safe distance above the water level by the constant addition of new building materials. A variety of different plants, depending largely upon the vegetative type in which the ducks located their nests, was used as nesting material. Redheads constructed their nests principally of 11 plant species. Some nests were composed entirely of one species, while

Figure 3. Cattail provides excellent nesting cover for Redheads. Round Lake, Clay County, Iowa.

others consisted of a mixture of plants. Dead, dry vegetation of the year previous constituted the largest percentage of nesting materials.

A consideration of the vegetation as it affected the productivity of the Redheads involved, among others, two important factors: (1) the availability of the vegetative cover, and (2) the use made of the available vegetative cover. The availability of the vegetative cover was ex-

pressed in acreage of each plant species present. The use made of the available vegetation was determined by estimation of the percentage of each plant species built into the nest and the numbers of nests located within each plant cover type. Based on the above factors the vegetation in order of importance to the Redheads was as follows: hardstem bulrush, riverbank sedge, bur reed, cattail, sweet flag, reed, and slough grass.

Detailed measurement of each nest under observation showed that the water depth preferred for nest construction was about 15 inches, although nests were located in water varying from 1 to 36 inches. The top of the nest was above the soil an average of 22 inches. In agreement with measurements given by Bent (1923), the nests averaged 16 inches in outside diameter and 7 inches inside diameter. While the depth of the cup or bowl of the nest varied considerably, the average of measurements were 3 inches.

The nests were constructed in the emergent vegetation out in the marshes an average of 70 yards from the high water mark. Nests varied from one yard to 250 yards, with an average of 60 yards, from large bodies of open water.

Redheads selected nesting sites having open accessible water either naturally or artificially supplied. The average distance to open water bodies over 10 feet in diameter was 35 yards. Sixty-four per cent of the nesting population under observation used the water provided by the clearings around muskrat lodges as the focal point for their nesting activities. In the duck-nesting investigations on the Bear River Refuge Williams and Marshall (1938) showed the greater number of Redhead nests was located within a few feet of open channels of water.

Sixty per cent of the nests were located in very dense vegetation containing above an average of 100 stalks of the cover plant to one-half square meter, and 40 per cent of the nests were located in medium dense vegetation containing between 50 and 100 stalks of the cover plant to one-half square meter.

The Redhead nests were built in the matted emergent vegetation or in clumps of the plants. Often the nest had no solid foundation other than the stalks of the plants, but more frequently, even though the nest was constructed in dense plant growth, the foundation of the nest went down to the soil. An interesting observation was the manner in which the Redheads added nearby vegetation to their nests in their attempts to raise the eggs above the rising water resulting from a heavy rain. The success or failure of the nest at this critical period depended largely upon the type of vegetation in which the nest was constructed. Hardstem bulrush appeared to be the most successful building material for these emergencies, probably because of the rapid rate at which nests could be constructed of it. Where the female had broken off the vegetation to add to her nest it was not an uncommon sight to

see nests, following a severe storm, situated in the middle of clearings six to ten feet in diameter.

The Redheads did not appear to be affected by other birds nesting in the immediate vicinity of their nests. American Coot and Pied-billed Grebe (*Podilymbus podiceps*) nests were located within a yard of Redhead nests without causing nest failure to any of the birds. The shortest distance between Redhead nests was 5 yards, although Rockwell (1911: 192) records 2 nests within 2 feet of each other.

Sixty per cent of the Redhead nests possessed an overhead covering. These cupolas were constructed by bending the vegetation down over the nest, or the nest was located in vegetation dense enough to provide such a covering without assistance from the ducks. Sixty-six per cent of the nests observed were constructed with 1 to 4 ramps or paths of piled vegetation leading from different sides of the nests to the water.

Figure 4. Protected bays as pictured above are favorite feeding haunts for both adult and juvenile Redheads. *Lemna* spp. form the principal floating plants; sago pondweed (*Potamogeton pectinatus*) and coontail (*Ceratophyllum dimersum*) are the most important submerged plants.

Juvenile Rearing Cover

The Redhead females reared their young in vegetation similar to that used as nesting cover. The broods were kept close to the tall bulrush, cattail, reeds, and other protective cover while feeding or playing. Rarely were juveniles observed over 50 yards from protective vegetative cover.

TABLE 1

1938 NESTING DATA ON THE REDHEAD IN CLAY AND PALO ALTO COUNTIES, IOWA

Vegetation in which the nests were located	Total nests	Successful nests	Unsuccessful Nests		Total eggs	Hatched eggs	Infertile eggs	Dead embryos	Eggs in unsuccessful nests
			Destroyed	Deserted					
Scirpus acutus	3 *(7.14)	3 (7.14)			32 (8.32)	25 (6.51)	1 (0.26)	6 (1.56)	
Scirpus acutus, *Carex riparia*	16 (38.09)	8 (19.04)	4 (9.52)	4 (9.52)	139 (36.20)	66 (17.19)	10 (2.60)	14 (3.65)	49 (12.76)
Scirpus acutus, *Scirpus fluviatilis*, *Carex riparia*	4 (9.52)	2 (4.76)	1 (2.38)	1 (2.38)	39 (10.15)	12 (3.13)		5 (1.30)	22 (5.72)
Scirpus acutus, *Carex riparia*, *Sparganium eurycarpum*	2 (4.76)	2 (4.76)			15 (3.91)	12 (3.13)	3 (0.78)		
Scirpus acutus, *Carex riparia*, *Acorus calamus*	3 (7.14)		2 (4.76)	1 (2.38)	27 (7.03)				27 (7.03)
Carex riparia	6 (14.28)	1 (2.38)	4 (9.52)	1 (2.38)	84 (21.87)	2 (0.52)	1 (0.26)	2 (0.52)	79 (20.58)
Carex riparia, *Phragmites communis*	2 (4.76)	1 (2.38)		1 (2.38)	13 (3.39)				13 (3.39)
Typha sp.	2 (4.76)	2 (4.76)			9 (2.35)	9 (2.35)			
Phragmites communis	3 (7.14)	3 (7.14)			14 (3.64)	10 (2.60)	1 (0.26)	3 (0.78)	
Spartina pectinata	1 (2.38)	1 (2.38)			12 (3.13)	11 (2.86)	1 (0.26)		
Totals	42 (100)	23 (54.74)	11 (26.18)	8 (19.04)	384 (100)	147 (38.29)	17 (4.42)	30 (7.81)	190 (49.48)

* Numbers in parentheses are percentages.

Plant species making up the most important rearing cover were located throughout the area of study in four plant communities. Hardstem bulrush and river bulrush growing together were used more extensively than other cover types. These plants grew best in water up to three feet deep and were found farther from shore than the remaining emergent plant species. A plant community consisting of river bulrush, giant bur reed, and sweet flag was second in importance as rearing cover and occupied a strip near the edge of potholes and marshes. Cattail and reed which grew in the same habitat were used to some extent as juvenile rearing cover. Sedges (*Carex riparia, C. atherodes*) growing with sweet flag and giant bur reed in the shallow water on the edges of potholes and marshes were used less extensively as a juvenile rearing cover.

Brood Counts and Production

In order to arrive at the number of young Redheads produced to a brood in 1938 it was necessary to determine the loss of juvenile ducks from predation and other mortality causes. This loss was determined by counting the numbers of juveniles to a brood observed throughout the rearing period. The average size brood of Redheads as determined from brood counts made throughout August was seven juveniles. From these brood counts it appeared that of the average clutch of 8.4 eggs in the successful nests 7 juveniles reached maturity and apparently entered the fall migration.

It was calculated by checking the numbers of pairs of Redheads on the area under study during the height of the nesting season and by counting the number of broods on the same area that not over 45 per cent of the nests were located. On this basis it was further calculated that on the total marshes and lakes about 90 Redhead nests were constructed. This represented an average of one nest to 16 acres of vegetation-covered marsh land. Since 54.74 per cent of the nests (49 nests) were successful and of each successful clutch 7 juveniles reached maturity, the total number of Redheads reared in the marshes and lakes of Clay and Palo Alto Counties in 1938 was about 340, or an average of approximately 3.8 young for each breeding pair of Redhead.

Summary

The investigation presents the available data on the extent and success to which the Redhead (*Nyroca americana*) nested in Clay and Palo Alto counties, Iowa, in 1938.

This investigation showed that the nesting season extended from May 1 to July 16 and that of the 42 nests under observation, 23 (54.74 per cent) were successful. Instability of the water levels, resulting in flooded nests, was the most destructive factor in the production of the Redhead. Of the 19 (45.26 per cent) unsuccessful nests 10 (52.63 per

cent) were flooded; 1 (5.26 per cent) was destroyed by Crows, and 8 (42.11 per cent) were deserted. Infertile eggs numbered 17 (4.42 per cent), while embryos were contained in a total of 30 (7.81 per cent) eggs left in the nests after the female had led the hatched ducklings away. Although 54.74 per cent of the nests were successful, only 38.29 per cent of the eggs successfully produced juveniles. As affecting the productivity of the Redhead, the most important plant species determined from this study were: hardstem bulrush, river-bank sedge, giant bur reed, cattail, sweet flag, reed, river bulrush, and slough grass.

Approximately 340 Redhead were reared in the water areas under observation and entered into the 1938 fall migration flight. This number represented an average of 3.8 juveniles reared to a breeding pair of Redheads, and an average of one nest to 16 acres of vegetation-covered marsh land.

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SEASONAL FOOD HABITS OF THE MARSH HAWK IN PENNSYLVANIA[1]

BY PIERCE E. RANDALL

THROUGHOUT the course of a management study of the Ring-necked Pheasant (*Phasianus colchicus*) in Pennsylvania, considerable attention was devoted to the determination of the relationships of birds of prey to the pheasant populations. As a means of ascertaining these relationships, the food habits of several species of raptors were investigated. This paper presents the information now available from this study on the food habits of the Marsh Hawk (*Circus hudsonius*).

This research was pursued under the supervision of Dr. Logan J. Bennett, Biologist, U. S. Bureau of Biological Survey, and Dr. P. F. English, Associate Professor of Wildlife Management, Department of Zoology and Entomology, The Pennsylvania State College.

The pheasant study was conducted on a 1,675-acre sample tract in Lehigh County in southeastern Pennsylvania. The study area is in the heart of first-class pheasant range and is also situated in the most productive agricultural section of the Commonwealth.

Despite the absence of marshes or swales Marsh Hawks were common on the study area throughout the year. From late in summer until spring, they utilized weedy grain stubblefields as roosting sites. During the spring the Marsh Hawks sometimes roosted in waste areas that maintained a luxuriant growth of weeds from the previous year. Three of the four nests located during this study were in wheatfields, and the fourth was in a dense stand of reed canary grass (*Phalaris arundinacea*).

Pellets were collected weekly from the roosts. Between August 15, 1938, and September 15, 1939, a total of 598 pellets, containing 762 items of prey, were collected and analyzed. The pellets cast by Marsh Hawks are fairly good for quantitative work, especially in fall and winter. The technique described by Errington (1930, 1932) was followed in the analysis, and only bones of vertebrates and skeletal parts of insects were used in the determination of numbers of prey.

In the following discussion the material will first be presented by seasons and will then be summarized for the year.

Fall Food Habits

During the fall (September, October, and November, 1938) the diet of the Marsh Hawks ran largely to mice (Table 1). Birds were of some importance as food, making up 18.4 per cent of the fall food items.

[1] Paper No. 12 from the Pennsylvania Cooperative Wildlife Research Unit. The Pennsylvania State College and the Pennsylvania Game Commission, cooperating with the U.S. Bureau of Biological Survey.

Authorized for publication on Feb. 20, 1940 as Paper No. 957 in the journal series of the Pennsylvania Agricultural Experiment Station.

The only game bird taken during these months was an immature Ring-necked Pheasant, occurring in an early September pellet. Smaller birds identified in the fall pellets included 15 Flickers (*Colaptes auratus*), 2 Song Sparrows (*Melospiza melodia*), and 2 Starlings (*Sturnus vulgaris*).

It is conceivable that the common skunk (*Mephitis nigra*) and the domestic cat (*Felis domestica*) in the fall pellets may have been carrion, for a relatively weak-clawed raptor like the Marsh Hawk would certainly have considerable trouble in capturing and killing adults of these species.

Winter Food Habits

As the weather became colder, mice became even more important as a Marsh Hawk food; birds were only infrequently represented in the pellets (Table 1). No game birds occurred in the winter (December, 1938, to March, 1939) pellets. Small birds included 5 Song Sparrows, 2 Tree Sparrows (*Spizella arborea*), and 1 Junco (*Junco hyemalis*). Seven songbirds were not identified.

Cottontails (*Sylvilagus* spp.) seemed to be the only game species eaten by the hawks during the winter. Remains of these animals were found in nine pellets and represented 4.7 per cent of the winter prey.

The winter diet of the Marsh Hawk was greatly influenced by the weather (Randall, 1939). A period of deep snow made mice difficult to obtain. The hawks were then forced to depend to a larger extent on cottontails and small birds for food. It was interesting to note that five of the nine cottontails represented in the winter pellets were taken during a 10-day period when the snow was more than a foot deep.

Spring Food Habits

With the coming of spring, the emergence of certain mammals from hibernation and the northward migration of hordes of small birds made food easier for the Marsh Hawks to obtain. Although the spring (April and May, 1939) data are fewer than those for the other seasons, they indicate that birds again became an important Marsh Hawk food at this season of the year. Avian prey in the spring pellets included 1 Rock Dove (*Columba livia*), 16 Flickers, 4 Starlings, 1 Redwing (*Agelaius phoeniceus*), and 8 unidentified small birds.

Despite the increase of birds in the hawk's diet, mice were the most important source of food. The spring foods are also summarized in Table 1.

Summer Food Habits

In the summer of 1939 a great variety of prey was available to the raptors. Easily captured juveniles, both avian and mammalian, abounded. Reptiles and amphibians were also numerous and could easily be obtained by an alert hawk.

TABLE 1

SEASONAL FOODS OF THE MARSH HAWK, 1938–39

Season of year	Fall		Winter		Spring		Summer	
Number of pellets examined	177		156		80		185	
Kind of prey	(a)	(b)	(a)	(b)	(a)	(b)	(a)	(b)
Mice (*Microtus* spp., *Peromyscus* spp., *Pitymys* sp., and *Zapus* spp.)	179	76.5	159	83.7	46	52.9	99	39.6
Shrews (*Sorex* sp. and *Blarina* sp.)	2	0.8	1	0.5	2	2.3	4	1.6
Chipmunks (*Tamias striatus*)	...	...	...	...	3	3.4	2	0.8
Red squirrel (*Sciurus hudsonicus*)	1	0.4	...	...	...	...	...	...
Cottontails (*Sylvilagus* spp.)	4	1.7	9	4.7	4	4.6	21	8.4
Skunks (*Mephitis nigra*)	1	0.4	...	...	...	...	1	0.4
House cat (*Felis domestica*)	1	0.4	...	...	...	...	...	...
Weasel (*Mustela* sp.)	1	0.4	3	1.6	...	...	...	...
Muskrat (*Ondatra zibethica*)	...	...	1	0.5	...	...	...	...
Unidentified mammals	1	0.4	1	0.5	...	...	...	...
Ring-necked Pheasants (*Phasianus colchicus*)	1	0.4	...	...	...	...	6	2.4
Mourning Doves (*Zenaidura macroura*)	...	...	...	...	...	...	4	1.6
Picidae (mostly Flickers)	15	6.4	...	...	16	17.8	31	12.4
Other birds (mostly passerines)	27	11.6	15	7.9	14	16.7	66	26.4
Domestic fowl	...	...	...	...	...	...	2	0.8
Snakes (*Thamnophis* spp.)	1	0.4	...	...	2	2.3	6	2.4
Frogs (*Rana* sp.)	...	...	1	0.5	...	...	8	3.2
Insects	...	...	trace	trace	trace	trace	trace	trace
TOTALS	234	99.8	190	99.9	87	100.0	250	100.0

(a) Number of individuals.
(b) Percent of total.

Despite the abundance of other prey, mice were the most important food of the hawks (Table 1). These rodents were eaten most extensively late in summer after the harvest. The standing grain early in summer protected the mice and made them difficult for the hawks to obtain.

Early in summer (June and early in July, 1939) juvenile birds were the most important food of the hawks. The new-mown hayfields were an excellent hunting ground. Many Eastern Meadowlark (*Sturnella magna*), Redwing, Bobolink (*Dolichonyx oryzivorus*), and Field Sparrow (*Spizella pusilla*) nests were on the ground or on the weeds in the hay. After the mowing these nests lay on the ground with the young exposed to the elements and to any predator that happened along. Marsh Hawks were apparently aware of this easy source of food, for they were frequently observed cruising over recently mown hayfields. A large proportion of the young ground-nesting passerine birds in the summer food items were secured in this manner.

To obtain as many quantitative data as possible on the early summer food habits, juvenile Marsh Hawks were tethered at the nests in the manner described by Errington (1932). Three young hawks were held captive and fed by the parents for several weeks after they would ordinarily have been fending for themselves. The gullets of the juveniles were emptied daily or twice daily by squeezing, and the contents were analyzed. Sixty-one gullet collections were obtained by this method. After the gullets were robbed, the young hawks were sometimes force-fed natural foods so that they would not suffer from a lack of proper nourishment.

The foods brought to the nest are listed in Table 2. These data were procured between June 20 and July 23. Juvenile birds of ground-nesting passerines were the most important items of food.

TABLE 2

FOODS BROUGHT TO THE NEST, 1939

Kind of prey	Number of individuals	Per cent of total
Mice (*Microtus* spp.)	14	20.9
Young cottontails	7	10.4
Young Ring-necked Pheasants	2	3.0
Young Mourning Doves	2	3.0
Flickers	5	7.5
Young Killdeers	2	3.0
Young passerine birds (Meadowlarks, Redwings, Bobolinks, Robins, Sparrows, and Grackles)	30	44.9
Domestic chickens	2	3.0
Frogs	2	3.0
Garter snake	1	1.5
TOTAL	67	100.2

Representatives of game species found among the summer foods (specimens brought to the nest and items found in pellets) included 8

Ring-necked Pheasants, 6 Mourning Doves (*Zenaidura macroura*), and 28 cottonails. Most of these were juveniles.

Other miscellaneous summer foods included shrews, chipmunks, snakes, frogs, and insects. The reptiles, amphibians, and invertebrates were most numerous in the late summer pellets.

Late in summer the parent hawks gradually ceased feeding their offspring, and the latter learned to hunt for themselves. The young had considerable difficulty in obtaining enough to eat when they began to hunt for themselves. Although no quantitative data are available on the food habits of the young after leaving the nest, observations indicate that they fed on fresh carrion, insects, snakes, and other slow-moving prey. Errington and Breckenridge (1936) reached somewhat similar conclusions regarding the food habits of juveniles during their first weeks of hunting.

English (1933) related an instance in which young Marsh Hawks, forced by circumstances to begin hunting unusually early in life, became serious predators of pheasants and had to be killed. He believed this to be an unusual case, however, rather than a normal one.

Relation to Game and Economic Status

As a prelude to discussion of the economic status of the Marsh Hawk in the Pennsylvania pheasant range, the foods for the year were totaled in Table 3. There was a slight preponderance of data from the summer season and a smaller amount of spring data. This condition tended to overemphasize the importance of birds in the yearly diet, as summer was the time when most of the avian prey was taken.

Nine Ring-necked Pheasants, apparently all juveniles, were taken by Marsh Hawks on the study area during the summer. The pheasant

TABLE 3

Foods for the Year, 1938–39

Kind of prey	Number of individuals	Per cent of total
Mice	500	60.3
Shrews	9	1.1
Cottontails	45	5.4
Chipmunks	5	0.6
Red squirrel	1	0.1
Weasels	4	0.5
Skunks	2	0.2
Muskrat	1	0.1
House cat	1	0.1
Unidentified mammals	2	0.2
Domestic fowl	4	0.5
Ring-necked Pheasants	9	1.1
Mourning Doves	6	0.7
Flickers	66	8.0
Other birds (mostly small passerines)	154	18.6
Frogs	11	1.4
Garter snakes	9	1.1
Total	829	100.0

population studies revealed that 776 young Ring-necked Pheasants were hatched on the study area during the summer of 1939. Although the nine young birds captured by Marsh Hawks represented 9.4 per cent of the juvenile mortality, they made up only 1.2 per cent of the juvenile population. This was a very slight loss and was of particular interest because of the high pheasant population maintained on the study area. The sample tract supported in fall a pheasant density of about one bird to 2 acres.

Errington and Hamerstrom (1937) reported that pheasant broods in areas heavily hunted by Marsh Hawks shrank in size at the same rate as did broods in areas where these hawks were rare. They found no perceptible relation between the conspicuous preying of local Marsh Hawks and the seasonal shrinkage in the size of pheasant broods. Apparently mortality from other causes occurred when Marsh Hawks were absent.

Neither pellet analyses nor careful field observations revealed any depredations on adult pheasants by Marsh Hawks. Adult Ring-necked Pheasants exhibited little fear of this species of hawk. It was not uncommon for a flock of pheasants in the open to feed unconcernedly while a Marsh Hawk flew past a few feet overhead.

Remains of four young Mourning Doves were found in adult summer pellets, and two others were fed to nestlings. In view of the large nesting population of doves on the area, this was a comparatively small loss. At least 40 pairs of doves—probably many more—nested on the study tract. As a rule, Morning Dove nests were too well concealed from above for the nestlings to be discovered by Marsh Hawks.

Traces of cottontails appeared 45 times in the yearly diet of the hawks, but 28 of these were taken during the summer. Some of the rabbits were probably eaten as carrion. Marsh Hawks were frequently observed feeding on the carcasses of rabbits killed by automobiles. The victims of haying or harvesting were another source of carrion cottontails utilized by the hawks. Many cottontails, especially juveniles, were struck and killed by the mowing-machines or grain binders. On one occasion a Marsh Hawk was seen carrying the carcass of a half-grown rabbit that had been killed by a binder. Unfortunately, it was impossible to determine how many of the cottontails eaten by the hawks represented carrion. Even if all the rabbits occurring in the pellets were considered kills (which they certainly were not), the Marsh Hawk could hardly be thought a limiting factor on the cottontail population of the study area. Although cover was sparse in parts of the study tract, a good cottontail population persisted. The kill by hunters in the fall of 1938 was about one rabbit to 5 acres, and an adequate breeding stock was left.

When determining the economic status of the Marsh Hawk, one must recall that a large part of the avian prey listed in Table 3 was pro-

cured by the hawks as carrion or after the young birds had been exposed by the activities of man.

Among the birds, only the Flicker seemed to have a steady place in the Marsh Hawks' diet. This woodpecker was taken during all seasons except winter and represented 8 per cent of the yearly food. The Flicker, a relatively slow flyer and often found in the open, probably was an easy prey for the hawks. This preying upon Flickers causes some economic loss, as their general food habits are quite beneficial to man (Beal, 1911).

Mice were the staple food of the hawks in all months of the year except June and July. More than 60 per cent of the total yearly food items consisted of these animals. These rodents are injurious to crops, and the destruction of these mice is a decided benefit to man. Other so-called destructive mammals in the hawks' diet included chipmunks, red squirrels, and weasels.

The general food habits studies by Fisher (1893) and McAtee (1935), based on stomachs collected throughout the year from all parts of the United States, indicated that mice and other injurious rodents were staple Marsh Hawk foods. In both studies more than 40 per cent of the stomachs contained the remains of one or more rodents. Stoddard (1931) found the skeletal parts of cotton rats (*Sigmodon hispidus*) in 925 of the 1,098 pellets examined from roosts on Marsh Hawk wintering grounds in Leon County, Florida. Cotton rats were serious competitors of quail for food and destroyers of quail eggs, and Stoddard concluded that by destroying these rats the Marsh Hawks were important benefactors of the Bob-white in that region.

Summary

Mice formed the staple food of the Marsh Hawk during 10 months of the year. During June and July juvenile birds were the most important items of food. Many young birds were easily obtained at this season because of their exposure by mowing and harvesting.

The effect of Marsh Hawks upon the pheasant population was negligible. There was no reason to believe that the hawks were a limiting factor on the other game species on the study area.

The general food habits of the Marsh Hawk are beneficial to man, and this hawk is a decided asset to an agricultural community.

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BIBLIOGRAPHY OF CALIFORNIA ORNITHOLOGY. THIRD INSTALLMENT. TO END OF 1938. By Joseph Grinnell. Pacific Coast Avifauna No. 26. Dec. 8, 1939. (235 pp.). $4.00.

As Joseph Grinnell himself once said, "It is only through the laborious activities of indexers and bibliographers that the working ornithologist can gain access to, and keep track of, the huge literature in his field." In this important branch of ornithological work Dr. Grinnell was long a leader, and with the publication of this volume he had completed the gigantic task of recording 6,840 scientific references to California birds which appeared in print before 1939. The thoroughness of his search can be attested by all ornithologists who have used his earlier volumes of bibliography. They know how rare it is to find an over-looked title.

If anyone thinks that a book made up principally of 2,769 references must be dull, he will be surprised by the exciting reading to be found in this volume. A large proportion of the references are annotated by Grinnell, and these critical or explanatory comments greatly increase the value of the bibliography. His precise use of a large vocabulary gives a most refreshing and characteristic flavor to many of the notes.

In addition to the list of titles there is an index to the 612 authors, an index to local lists, and an index to bird names, both common and scientific.

We are not yet wholly convinced that a chronological grouping of titles is the best possible arrangement of such a bibliography but, perhaps, once begun it must be continued. The format of this volume follows that of the earlier ones, including the rather extravagant spacing of titles on the page and the inconvenient and space-consuming use of Roman numerals for volume numbers.

This is not just another reference work to be filed away for possible use; it is a book to be *read* by all serious ornithologists. It brings to us a sharp realization of how much we are going to miss Joseph Grinnell.—J. VAN TYNE.

DU BUS' TYPE OF THE COLLARED TOWHEE, *PIPILO TORQUATUS*

BY A. J. VAN ROSSEM

IN 1847,[1] Du Bus published the description of a Collared Towhee from "Mexico" under the name of *Pipilo torquatus* and later, in 1851, pictured the individual in plate 36 (livr. 7) of his "Exquisses Ornithologique." About twenty years later Lawrence described[2] *Buarremon ocai* from Jalapa, Vera Cruz, but in accordance with the opinions of Salvin[3] and of Salvin and Godman[4] this latter name has rested peacefully in the synonymy of *Pipilo torquatus*. It must now be revived for the reasons given below.

Du Bus' original diagnosis and plate by no means describe or picture the collared towhee which for so many years has passed as *torquatus*, in fact they are so at variance that it is difficult to understand why they were ever confused. The type of *torquatus* is still extant in the Musée Royale d'Histoire Naturelle in Brussels, where I examined it in July, 1939, and verified the characters originally ascribed. Briefly, it is an obvious hybrid between what has currently been called *torquatus* and some other *Pipilo*, probably *maculatus*. Notes made at the time are as follows:

"No. 7391 Brussels Museum, marked as "♂"; no locality (other than "Mexique"), nor is there any indication of the original source either in the register or on the stand. It is apparently fully adult. Measurements are: wing 86; tail, 103; exposed culmen, 14.5; depth at base, 10.3; tarsus, 30.7; middle toe minus claw, 19.2; hind toe with claw, 19.0 mm. Plumage fresh, though showing slight abrasion as though collected, perhaps, in midwinter. The specimen may have faded somewhat, though obviously in no great degree. It is mounted on a small, conventional, bar perch and is in good condition.

"Forehead solidly black to a line at posterior corners of eyes, with no trace of median crown stripe; hind part of crown rufous brown, heavily variegated with black tipping and bounded laterally with broad stripes of black [in other words the chestnut patch is obsolescent]; superciliary stripes very narrow and solidly white only on the supra-loral region, with about equal amounts of black and white posterior to the eyes; pectoral collar brownish black and 10–12 mm. broad; sides, flanks, and under tail coverts grayish brown [originally described as "rufis"]; black grayish green, the feathers with broad (1–2 mm.), central streaks of dull black; rump and upper tail coverts with a distinct brownish tinge; lateral rectrices with an irregular creamy white spot (12 mm.) on inner webs; next pair with only the tip of the inner webs white."

[1] *Bull. Acad. Roy. Sci. Belgique*, 14, pt. 2, 1847 (séance of Aug. 7): 105.
[2] *Ann. Lyc. Nat. Hist. New York*, 8, 1863–1867 (read May 1, 1865): 126.
[3] *Ibis*, 1874: 315.
[4] *Biologia Cent.-Amer., Aves*, 1, 1886: 399.

Since *torquatus* is not available as a specific name for the typical Collared Towhees, *ocai* will have to replace it. Thanks to the courtesy of Mr. John T. Zimmer of the American Museum of Natural History, I am able to examine one of Lawrence's two cotypes, both of which (*fide* Zimmer) are practically identical in all particulars. Both were collected by Rafael Montes de Oca at Jalapa, Vera Cruz, but further data are lacking. A comparison of the specimen forwarded (Amer. Mus. No. 41, 669) with the original description indicates little or no post-mortem color change. In characters it exhibits the relatively dark brown sides and under tail coverts typical of the race which inhabits the mountains of Vera Cruz and eastern Puebla.

The final solution to the whole complex problem of the relationships of the *ocai—macronyx—maculatus* group of towhees will come only after a long study of all available material combined with competent field observation. It is not impossible, though improbable, that the numerous intermediate specimens, some of which have received names, will prove to be, in some instances, valid connecting forms. At present it seems safest to regard them as hybrids. Undiluted *ocai* apparently has at least four recognisable races. These are:

Pipilo ocai ocai (Lawrence)
Mountains of central Vera Cruz and eastern Puebla.

Pipilo ocai brunnescens van Rossem [5]
Mountains of central and northern Oaxaca

Pipilo ocai alticola (Salvin and Godman)
Mountains of Colima and Michoacan

Pipilo ocai guerrerensis van Rossem
Sierra Madre del Sur, Guerrero

DICKEY COLLECTIONS, CALIFORNIA INSTITUTE OF TECHNOLOGY, PASADENA, CALIFORNIA

[5] The differences between *ocai* and *brunnescens*, described in 1938 (*Bull. Brit. Orn. Club*, 58, July, 1938: 131) are readily recognizable in the British Museum series, but less so in American material more recently examined. More specimens are needed for final disposition of the case. A series of five *guerrerensis* in the Biological Survey collection confirms the validity of that race, originally named in the paper cited above on the basis of six specimens in the British Museum.

THE INLAND BIRD BANDING ASSOCIATION

BY O. A. STEVENS, SECRETARY

Organization and Early History

THE Inland Bird Banding Association was organized at Chicago, Illinois in October, 1922, during a meeting of the American Ornithologists' Union. Organization was brought about largely through the efforts of William I. Lyon of Waukegan, Illinois, who had previously sent out letters to about seventy-five people whom he thought would be interested in the project. Dr. S. Prentiss Baldwin [1] was chosen the first president and Mr. Lyon, secretary. The history of the Association continued to center around the work of Mr. Lyon, who later became president and, until his death on June 13, 1938, was always its chief promoter.

In March, 1922, a few months before the Association was organized, Mr. Lyon began editing the "Bird Banding Department" of *The Wilson Bulletin* and continued to do so until June, 1928, with two to eight pages in nearly every number. In the first issue there was an account of the organization of the New England Bird Banding Association in January of that year. In the December number of 1922 (pp. 226–33) "a copy of the minutes of the first activities of the Inland Bird Banding Association" appeared, telling of the organization as described in the above paragraph.[2] In September of the following year it reported the organization of the Eastern Bird Banding Association. In the same number Mr. Lyon presented a list of birds banded in the Inland district, of interest in comparison with the many thousands of birds banded annually at the present time. Fifty-one people had banded 5818 birds, of which 2481 were by Mr. Lyon, Mr. W. S. McCrea of Chicago, and Mr. M. J. Magee of Sault Ste Marie, Michigan.

The December number of 1923 reported a convention held in Indianapolis with the Indiana Audubon Society and the Nature Study Club of Indiana on November 2. In this report is a "Bibliography of Bird Banding in America" (more important papers only) by Dr. Baldwin, with the comment that he had supplied copies of most of them to the United States Biological Survey in sufficient quantity to distribute to all people holding banding permits. Included also is a list of the regional associations with their officers and territories.

In June, 1929 the Association began the publication of *Inland Bird Banding News*,. a quarterly mimeographed publication. The first two volumes contained only three numbers each. Mr. Lyon was president and Professor J. W. Stack, secretary. The December, 1929 issue reported upon a meeting held in St. Louis, Missouri, November 9–10. The next meeting was held at Cleveland, Ohio, December 30, 1930, at

[1] See an account of Dr. Baldwin by Kendeigh, *Auk*, 57: 1-2, 1940.
[2] The writer still has on hand a few separates of this article.

which time Edward R. Ford was elected secretary. Mr. Ford continued in this capacity until November, 1938, when he was succeeded by the present Secretary.

The tenth annual meeting was held in Chicago with the Chicago Ornithological Society and the Illinois Audubon Society on November 27–28, 1931. Meetings continued to be held in Chicago until 1937. Business meetings without special programs were held in conjunction with the meetings of the Wilson Club in 1938 and 1939. For the 1934 meeting, the present Secretary prepared a map of the 297 banding stations in the United States and Canada at which had been banded more than 100 birds during the preceding year. This was published in the January, 1935 number of *Bird-Banding*.

W. I. Lyon and the Inland Association

The history of the Association up to 1938 is largely a story of the tireless efforts of Mr. Lyon to extend and develop the study of birds by means of banding. He contributed extensively of his time and funds to this end. His annual tours, covering many states, always included visits to other banding stations. He had a form printed on which the number of birds of a species banded each month in the year could be recorded for many years, and repeatedly urged the use of this to systematize station records. He also undertook to furnish traps and other supplies for banders (*I. B. B. News*, 4, No. 1: 12), and we suspect that he was responsible for an extensive distribution of publications by the Association (*Ibid.*, p. 14). Reports of his summer banding expeditions appeared regularly from 1931 onward, though the one for that year, on which 4657 birds were banded, was said to be the eighth expedition (*Ibid.*, 3 No. 3: 7). In later years his Cowbird studies occupied much of his attention (*Ibid.*, 7, No. 1: 7; 9, No. 2: 9; 10, No. 2: 3).

One of Mr. Lyon's largest projects was one to develop interest in bird banding in the Latin American countries. We find a statement (*Ibid.*, June, 1929: 5) that forty volumes of collected papers on bird banding had been bound and distributed by Dr. Baldwin to as many museums of the principal countries of South America. An illustrated three page article was prepared and published in the January, 1936 issue of *Revista Rotaria*, the Spanish magazine published for Rotary International. A similar article previously appeared in *The Rotarian*. Another appeared in the Spanish and Portuguese editions of the *Bulletin of the Pan-American Union* for February, 1938.

Other Active Members

Among others who were specially active in the early work of the Association mention should be made of M. J. Magee, J. W. Stack, and E. R. Ford. Mr. Magee has completed ten years of service as its treasurer, and many others have been faithful contributors. Of the fifty-two

persons who assembled for the meeting in 1922, seven are still among the members. Present available records show at least the following thirty persons have been members for ten years:

J. F. Brenckle
Oscar M. Bryens
K. Christofferson
Miss Marion Clow
Leon J. Cole
E. R. Ford
Christian J. Goetz
Mrs. Marjorie Lee Guest
H. H. Hayes
F. H. Herrick
Paul Wm. Hoffman
Geo. W. Luther
M. J. Magee
E. A. McIlhenny
Arthur D. Moore
Mrs. Blanche L. Morton
Mrs. B. F. Myers (Mrs. F. W. Commons)
Samuel E. Perkins, III
T. S. Roberts
Frank W. Robl
A. F. Satterthwait
Mrs. Elizabeth A. Satterthwait
A. R. Shearer
Frank Smith
J. W. Stack
O. A. Stevens
H. L. Stoddard
Mrs. John A. Thompson
George Wagner
George Stewart Wolfram

Territorial Scope and Aims of the Inland Association

The Inland Association's territory is a large one, reaching from Saskatchewan, Michigan, and Ohio on the north to Alabama and Texas on the south. Both the Inland and Western Associations have claimed Alberta, which lies in migration routes of both regions. Of the total number of banding permits held at the end of 1938, slightly less than half were in the Inland territory. Of this number 48 per cent were in the four states, Illinois, Ohio, Michigan and Wisconsin, which also had 60 per cent of the present Inland membership according to figures of 1939. The prairie states and southern states are poorly represented in numbers, but the southern states have some of our most active stations.

Mr. Lyon's plan was to have in each state and province a councilor who would keep in touch with the banders of that area, an excellent plan when a suitable person can be found who will give his time to the work. Professor Stack promoted state meetings, which seem to have been successful and are still continuing in Michigan.

In general the aims of the Association are to increase the extent and efficiency of banding work in the Inland district. The Association serves as a clearing house for information regarding methods and results of trapping, supplementing the work of the Fish and Wild Life Service (formerly called the U.S. Bureau of Biological Survey) in circulating such material. The *Inland Bird Banding News* is intended to carry items of current interest and also to help bring together material for ultimate publication.

The design and operation of traps are always major problems. The nature of the surroundings of the stations is important, and a study

of these in respect to bird behavior is not only essential to the success of the station, but also is a contribution to our general knowledge. Thus descriptions of individual stations are always of interest to other workers, and any of them may contain something of definite value. Types of bait used and method of keeping records are essential details.

Many people begin banding as an early interest in ornithology and have, perhaps, no other literature available than that which they receive as cooperators with the Fish and Wildlife Service. The present writer feels that it is this group of people which the regional associations should help particularly. The beginner needs suggestions and aid of many kinds. References to other work and to other publications help lead him into an appreciation of the possibilities contained in bird study. The individual stations are widely scattered, but often a group will develop in a locality as a result of the interest aroused by the first one. Such a group increases both interest and efficiency. A larger proportion of the entire population of the locality is banded, and birds banded at one station frequently are retaken at one of the others.

The data furnished by the banding and recovery of individual birds comprise only a small part of the contributions of this method of study to ornithology. Large numbers of birds are handled, but many of them for only a few minutes or even seconds. Methods of study during this brief interval are as yet little developed but are of great importance. Failure to capture birds banded at other stations has been a disappointment to many operators, and the other possibilities of interesting and useful studies continually need to be brought to their attention. The frequent daily visits to the traps make possible observations upon behavior. Most of the large numbers banded during migration may not be heard of again, but their banding has furnished definite statistical evidence upon distribution and migration.

The Inland Association is composed of banders located in the area crossed by two of the major flyways as outlined by Frederick C. Lincoln, namely, the Mississippi and Central Flyways. It has great possibilities of aiding the study of birds in this large region. It aims to help collect and correlate the information secured at the different stations, and call attention to study projects which are under way, or to other problems which should be undertaken. The educational values of banding operations are tremendous, and cooperation among the workers of a region will help to develop these. Bird banding is one of our largest cooperative programs, and effective regional coöperation is essential to its usefulness.

Fargo, North Dakota

SUMMER FOOD OF THE ROBIN DETERMINED BY FECAL ANALYSES

BY W. J. HAMILTON, JR.

THE food habits of North American birds have been the object of much study. The methods usually employed have been those of stomach analyses or direct observation of the feeding birds. These practices have been proved most useful and a voluminous literature has resulted. Little attention has been directed to the possibilities of determining avian food habits through a study of their fecal remains, although such methods are often employed when studying the dietary of predatory mammals.

W. L. McAtee (1908:23) writing of the nestlings of the Cardinal says:

> The character of the food could not be determined by observation, but it was learned in another way. None of the excrement was removed from the box, whereas the nest in which the youngsters had been was kept perfectly clean. The fecal matter was dried and examined, and while by no means all of its constituents could be identified, enough was learned to indicate that the study of excreta is a very satisfactory method of determining the food of nestling birds. The nest of any fairly bold bird may be kept under surveillance and the waste matter collected before the parents remove it. The extent of the information as to the food eaten by the young to be obtained in this way is astonishing.

From a single casting of a young Cardinal, McAtee recovered one insect egg, the leg and scutellum of a scarabeid beetle, head and other remains of a leaf hopper, bits of snail and 11 seeds and the core of a mulberry. Dalke (1935) has found that droppings provide a valuable source of information on the feeding habits of pheasants.

Several investigators have studied the food habits of the Robin (*Turdus migratorius*). The most detailed of these studies have been by several members of the U. S. Biological Survey. Beal (1915) reported on 1236 stomachs secured at various times of the year, the results of which indicate that 42 per cent of the Robin's food is animal matter, chiefly insects, while the remainder is composed principally of fruits and berries. Forbes (1903:96-115) examined 114 Illinois birds taken from February to December. The food consisted almost entirely of insects from February to May inclusive, but from that time forward these constitute but little over a third of its food, the remainder (64 per cent) being composed of wild and tame fruits. Taken as a whole, however, insects comprise almost precisely two-thirds of the food for the year. Earl Brooks (1939) has summarized well our present knowledge of this subject, listing 76 published references. From his report we find there is still a paucity of data on the summer food of the Robin. Forbes (*loc. cit.*) reported on 47 stomachs for June, July and August and found during this period that Robins were feeding principally upon caterpillars, Coleoptera, cutworms and fruit.

During the dry summer of 1939 I had an excellent opportunity to

study the feeding habits of Robins about my home at Ithaca, New York. These birds were attracted to a hedgerow of wild cherry (*Prunus virginiana*) from late June through early August. The birds usually perched on the bean poles in my vegetable garden prior to flying into the hedgerow and would often defecate while sitting there. Inasmuch as no other bird of comparable size and similar feeding habits utilized these poles (Starlings were never seen perching on the bean poles) it was assumed all the droppings collected below the supports were those of Robins. Water was placed in pans below the roosts, and the birds often drank there. Newspapers were spread below the bean vine supports and weighted down. In this manner the droppings could readily be seen and collected with ease. It took but a moment each day to collect the droppings. More than a quart of droppings, constituting well over 1000 samples, was secured; 700 of these were examined.

The droppings were soaked just prior to examination so that the various items would separate easily. Identification of Robin fecal remains are not difficult, for the stones and seeds of fleshy fruits are usually passed in good shape; adult insects are often passed in their entirety, while cutworms and similar insect larvae are preserved in unusually good condition (Fig. 1). No volumetric index to the different

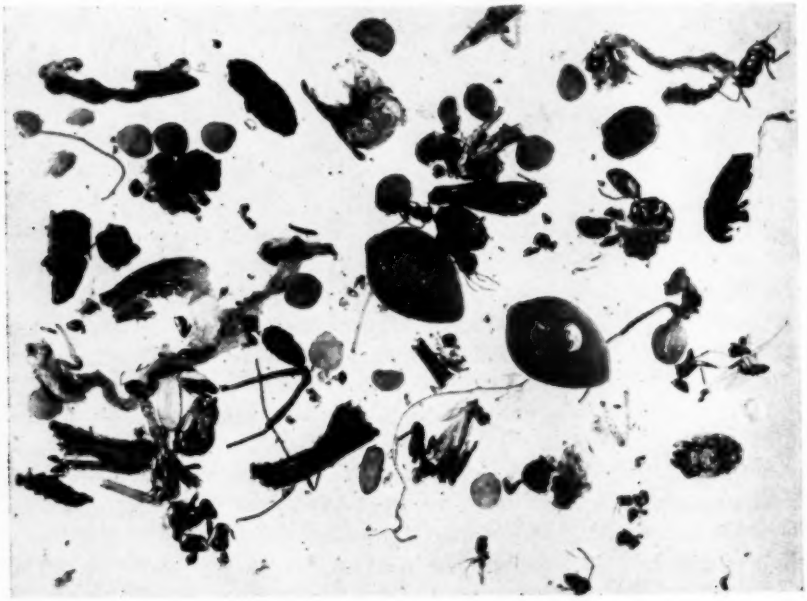

Figure 1. The remains from several Robin droppings, illustrating the ease with which identifications may be made. Cutworms, grasshopper fragments, larval European elm leaf beetles, ants (*Lasius*), various carabid elytra, entire weevils, and the seeds of wild cherry, raspberry, blue nightshade, and honeysuckle may be recognized.

TABLE 1

ANALYSES OF 700 ROBIN DROPPINGS COLLECTED BETWEEN JUNE 24 AND AUGUST 11, 1939. THE FIGURES INDICATE THE PER CENT FREQUENCY OF OCCURRENCE OF DIFFERENT FOOD ITEMS.

Animal		80.13
Annelida (Earthworms)	.57	
Arthropoda	78.86	
Arachnida	3.43	
Cheliferidae (Pseudoscorpions)	.43	
Phalangidae (Harvestmen)	.28	
Lycosidae (Wolf spiders)	1.57	
Araneae (Undet. spiders)	2.14	
Myriapoda	.43	
Chilopoda (Centipedes)	.43	
Insecta	74.06	
Orthoptera	5.57	
Locustidae	4.91	
Gryllidae	.57	
Coleoptera	11.30	
Scarabeidae	4.43	
Staphylinidae	.28	
Elateridae	.71	
Chrysomelidae	1.86	
Curculionidae	6.28	
Hemiptera	.71	
Pentatomidae	.57	
Miridae	.43	
Homoptera	.14	
Membracidae	.14	
Lepidoptera (Chiefly cutworm larvae)	6.86	
Mecoptera	.71	
Bittacidae	.71	
Hymenoptera	38.43	
Formicidae (*Lasius*, etc.)	34.47	
Parasitic Families	5.43	
Mollusca	3.28	
Valloniidae (*Vallonia pulchella*)	.71	
Cochlicopidae (*Cochlicopa lubrica*)	2.57	
Plant		73.14
Saxifragaceae		
Ribes satirum. Red Currant	1.14	
Rosaseae		
Amelanchier canadensis. Shadberry	2.43	
Fragaria virginiana. Field Strawberry	1.29	
Rubus idaeus. Raspberry	21.10	
Rubus alleghèniensis. Blackberry	40.09	
Prunus pennsylvanicus. Pin Cherry	17.00	
Prunus virginiana. Choke Cherry	58.29	
Prunus serotina. Rum Cherry	11.71	
Solanaceae		
Solanum dulcamara. Blue Nightshade	5.86	
Caprifoliaceae		
Lonicera sp.	8.28	

food items was obtained, for it is apparent that such reckoning would not be significant. The different food items have a variable rate and degree of digestion. Thus ants and billbugs were passed almost entire, whereas only the skin of cutworms and the seeds of fleshy fruits could be recovered from the droppings.

The best clue to the relative importance of the various food items was obtained by tabulating the frequency with which each item occurred in the total droppings that were studied. Thus the per cent frequency of occurrence gives us some index to the importance of the different good items discussed.

Droppings were collected from June 24 to August 11, 1939. It is surprising that the Robins restrict their diet to so few items during this period of 49 days. It hardly seems likely that any food item of importance could have escaped our notice, for even the smaller fragments were quite prominent. The scant selection may have been occasioned, in part, by a subnormal rainfall, for during this 7-week period there was only 4.67 inches of rainfall at Ithaca.

The droppings frequently contained certain characteristic remains which left no doubt as to their identity. Thus the Harlequin cabbage bug (*Murgintina histriona*), ants (*Lasius*), blue-grass billbugs (*Calendra parvulus*), strawberry root weevils (*Brachyrhinus ovatus*), larval European elm leaf beetles (*Galerucella luteola*), and a number of other insects were passed through the digestive tract entire and were easily determined. The male genitalia of *Phyllophaga rugosa* were found several times. On the other hand, some remains could not be certainly identified more closely than to family rank. The case is quite different with fruits. Seeds are usually determined with ease.

It appears probable that, under favorable conditions, the feces of many birds particularly in summer, could be profitable studied. Bird baths that are under close scrutiny should provide suitable material for analyses, and the species responsible for the droppings determined with certainty. Moreover, advanced nestlings of many species may be removed from the nest and placed in boxes where the feces may be collected and studied with a view to determining the specific nature of the diet.

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Cornell University, Ithaca, New York

THE 1939 NESTING SEASON OF BLUEBIRDS AT NASHVILLE, TENNESSEE

BY AMELIA R. LASKEY

AGAIN I have conducted the Bluebird (*Sialia sialis sialis*) nest-box project started in 1936 in Percy Warner Park in the suburbs of Nashville, Tennessee. Last year detailed results of the 1938 season were presented at the Wilson Ornithological Club meeting and later published (Laskey, 1939). The following analysis of the 1939 nesting data corroborates most of the conclusions reached last year and also indicates the effect of prevailing temperature differences on nesting activities.

This year, beginning February 16 and continuing through August, I made 55 trips to examine the boxes, representing almost 200 hours in the field. During school vacations, Arthur McMurray rendered valuable assistance. As last year, besides keeping records of the nest progress, banding the young, and removing old nests, I tried to capture and band the brooding birds.

In addition to the 38 Bluebird boxes already in place, 18 more were set out in late March and April of 1939 with the cooperation of Conrad Jamison, William Simpson, and McMurray. These boxes are in open meadows along paved roads. With two or three exceptions, they are at least 500 feet apart and are concealed from each other by the trees and narrow thickets which border the numerous meadows in the valleys and on the hillsides of this beautiful naturalistic park of 2141 acres. The boxes are larger than those placed by Mr. Musselman in the environs of Quincy, Illinois, the inside measurements being 5 x 5 x 10 inches. Experimenting with different sizes, we found that the birds are more successful in our southern climate if this roomier box is provided. There are no losses from smothering among the larger size broods, for as the nest cup becomes crowded the young move outward and flatten the entire mass of grasses with which the parents had filled the bottom of the box.

When the project was started most of the boxes were placed on posts 6 to 7 feet above the ground which necessitated carrying a ladder or climbing the post to examine the nest. This height, however, did not provide immunity from predation. Therefore to facilitate the banding of the birds and the removal of old nests, posts were cut so that boxes are now about 5 feet above the ground. To examine a nest, the top of the box is slightly raised and a small mirror is held above the opening at the proper angle to reflect the contents. Thus one does not obscure light by leaning over the opening, and the mirrored reflection reveals nest, eggs, nestlings, or brooding female clearly, eliminating unnecessary handling.

Of the 56 boxes in the park this year, 53 were occupied at least once during the season by Bluebirds, one was entirely monopolized by

House Sparrows (*Passer domesticus*), and 2 were vacant. There were 133 sets or 576 eggs laid, an average of 4.3 eggs per nest. This year there matured 290 nestlings or 50.3 per cent of the number of eggs laid. It was disappointing to find an increase of only 25 nestlings over last year's results and the percentage of successful eggs 7.3 per cent less than last year in spite of the larger number of boxes. Weather conditions seem to be an important contributing factor and there was a marked contrast between the two seasons. February and March 1938 were unusually mild with average day and night temperatures higher and with fewer fluctuations in daily range than in 1939. Vegetation was from two to three weeks in advance of that of 1939. Bluebird nesting activities also started early. Nest building began in February of 1938; a set of 4 eggs was being brooded on March 5. In 1939 nest building did not start until March; the first eggs were laid on March 18. The activitives of the Bluebird occupying Box 21 both years, raising three successful broods each season, is significant. In 1938 building of her first nest started February 23; in 1939 not until March 21. In 1938 her first egg was laid March 21; in 1939 on April 15. In 1938 her second set was started on April 28; in 1939 on June 5. For the third nesting period of 1938, her first egg was laid on June 9, but in 1939 it was on July 29. Last year she laid 14 eggs, two of which were sterile, and raised 12 nestlings. This year, she laid 15 eggs, five of which were sterile, and raised 9 young.

TABLE 1

THE NESTING PERIODS IN 1939

	First Period	Second Period	Third Period	Total
Number boxes available	49	56	56	
Number sets laid	47	50	36	133
Number with 1 egg	0	1	1	2
Number with 2 eggs	0	1	1	2
Number with 3 eggs	0	4	4	8
Number with 4 eggs	8	29	28	65
Number with 5 eggs	33	15	2	50
Number with 6 eggs	6	0	0	6
Total number eggs	233	206	137	576
Average number eggs per nest	4.95	4.1	3.8	4.3
Number sets entirely unsuccessful	17	23	19	59
Number eggs in unsuccessful sets	81	88	71	240
Number young fledged	139	99	52	290
Percentage of success based on number of eggs laid	59.7	48	38	50.3
Average young hatched per nest	3	2	1.4	2.18

Another factor which probably accounts for some of the results this year was the tardy placing of the 18 additional boxes. Bluebirds in Tennessee investigate possible nest sites on every mild day in winter

and early spring, later defending their chosen territories from other Bluebirds by fighting if necessary. For that reason the boxes placed in late March and April were not available at the nest-seeking time and only a few were used during the first period. The abundance of boxes apparently was responsible for the increasing tendency this year for a few brooding females to move to different boxes between nestings.

Percentages of success (i.e. young raised from total number of eggs laid) of the Bluebird nest box project at Nashville was found to be lower than at either Quincy, Illinois, or Cape Cod, Massachusetts. For Quincy T. E. Musselman (1935) reports as follows: 1933, 78.3 per cent; 1934, 66.6 per cent; 1935, 67.4 per cent. For Cape Cod Seth Low (1934) reports: 1932, 86.3 per cent; 1933, 64.6 per cent. In Nashville percentages for 1938 were 57.6 and 1939, 50.3.

This year 5 sets (24 eggs) of albino eggs were found. Each year there have been a few clutches of white eggs and they usually hatch successfully. So far we have traced no relationship between the various females laying such eggs. None of the offspring have been found nesting and we therefore have not been able to determine whether they lay

TABLE 2

COMPARISON OF 1938 AND 1939

	1938		1939	
	Numbers	Percentage	Numbers	Percentage
Number boxes used at least once	36		53	
Nests with 1 egg each	2	1.92	2	1.5
Nests with 2 eggs each	3	2.88	2	1.5
Nests with 3 eggs each	12	11.54	8	6.0
Nests with 4 eggs each	25	24.04	65	48.9
Nests with 5 eggs each	57	54.81	50	37.6
Nests with 6 eggs each	4	3.85	6	4.5
Nests with 7 eggs each	1	.96	0	0.
Sets of eggs laid	104	100	133	100
Total number of eggs laid	460		576	
Average number eggs per set	4.4		4.3	
Entirely unsuccessful nests	37	35.57	59	44.36
Sterile eggs	34	7.39	21	3.7
Unhatched fertile eggs	4	0.87	13	2.3
Disappeared from nest (eggs and nestlings)	103	22.39	108	18.8
Eggs deserted	18	3.91	95	16.5
Eggs and small nestlings destroyed by House Sparrows, Starlings, ants, etc.	36	7.83	49	8.4
Number nestlings leaving successfully	265	57.6	290	50.3
Average number young hatched per nest	2.54		2.18	

white or normally colored eggs. Musselman found one bird, apparently normal, that had been hatched from an albino egg returning to nest in one of his boxes and brooding a set of white eggs, thus showing that this trait may be inherited.

There were 286 eggs which either failed to hatch or which yielded nestlings that perished before fledging. Basing percentages on the total number of eggs laid, it was found that 21 or 3.7 per cent were sterile; 13 or 2.3 per cent fertile eggs did not hatch; 108 eggs and nestlings (18.8 per cent) disappeared from the nest. This included broken eggs and small dead nestlings removed by the parents as well as those taken by snakes and other predators. Thirty eggs and newly hatched nestlings were apparently destroyed by other birds for eggs were found pierced or thrown out and nestlings pecked. House Sparrows were guilty in some instances. Seven developing nestlings (1.4 per cent) were found dead in boxes, five of them when the mother bird was killed by a cat. Three July broods of hatching nestlings (2 per cent) were devoured by tiny ants. One invasion was noted at 5:30 A.M. in Box 16 as the parents flew in and out of the box in distress but made no attempt to kill the horde of ants swarming in the nest over pipped eggs and emerging nestlings. Returning a little later with pyrethrum powder and hot water, I found the parents had deserted and the dead baby birds were being rapidly devoured by the ants. Dr. M. R. Smith of the U. S. Department of Agriculture has identified these ants as *Solenopsis* sp. (*molesta* group).

Ninety-five eggs or 16.5 per cent were deserted, usually after depredations and disturbances. During the summer several park improvement projects, such as road paving and building of stone entrance gates, disturbed some of the birds. There was considerable evidence against cats which, unfortunately, are allowed to live in the park. In three or four instances, desertions may have been caused by the trapping of the brooding bird or by interference from casual park visitors.

Nest boxes placed at a distance from human habitations are more successful than those in close proximity to house or barns. Although Bluebirds learn to ignore passing automobiles when boxes are placed in meadows along highways, they seem more easily disturbed by activities around a home and seldom adapt themselves to noises and movements of a household as do Mockingbirds, Robins, and Cardinals. Around houses and barnyards they suffer much interference from House Sparrows. In the residential section of Nashville, landscaped city lots attract several species for nesting, but a box placed for Bluebirds on the lawn is rarely used. This point is well illustrated by the environment of our own home. A few years ago when the area was sparsely built, Bluebirds were numerous, but as the encroaching city is absorbing the vacant acreage with rows of houses, the birds are seen in smaller numbers, and most of the nest boxes remain unoccupied.

As in 1938 early nests were more successful than subsequent nestings. In both seasons, the first nesting period yielded a higher percentage of success than the second period, and the third period was lower than the second. The total number of eggs laid and the average number per nest decreased in each later period of both years. When analyzing the

nesting success of Bluebirds in Quincy, Illinois, where the species is a summer resident and has only two nesting periods per season, Musselman found that the first period was often more successful. In 1933 and 1934 the first period yielded a higher percentage of success than the second, but in 1935 the situation was reversed on account of a disastrous freeze in April. He says: "In spite of the drouth which caused material damage in the second nesting in 1934, the totals were similar (to those of 1933) but the rains, snow, and freeze of 1935 produced poor results in the first nesting, with birds more constant in the second nesting than usual."

TABLE 3

THE THREE NESTING PERIODS IN 1938 AND 1939 [1]

	1938			1939		
	1st	2nd	3rd	1st	2nd	3rd
Start of earliest nest	Feb. 23	Apr. 19	May 25	Mar. 2	May 1	June 15–
Start of latest nest	Mar. 23	May 19	July 4	Mar. 25	June 14	July 24
Nestlings fledged	123	90	52	139	99	52
Percentage of success	72.3	55.2	42.6	59.7	48	38

[1] In 1938 a fourth nesting period was attempted with two nests; July 23, 1 egg laid and deserted; July 25, 4 eggs, 1 nestling hatched but was found dead August 8. In 1939 there was no fourth attempt.

In compiling these dates I used only those that I was reasonably certain were of the same pairs in their respective boxes, progressing in a normal manner without interference from predators or disturbances. The pairs that started earliest with their first nest would be expected to complete their third brood earliest, but there is also a difference among individuals in the time elapsing between broods.

Some experimenting was attempted with deserted eggs. At various times five sets of marked eggs were transferred to other nests where small sets of approximately the same age were being brooded. These additions were accepted by the mother birds. Two sets of the transferred eggs disappeared with the original eggs of two nests. Two sets were either sterile or had been chilled before transferring; one of these sets had been substituted for House Sparrow eggs just being laid. Both male and female sparrows brooded them for twelve days before deserting. One set of two eggs was hatched by the foster mother on the same day as her own. This proved to be a fortunate arrangement, for although three of her four eggs were sterile, the pair successfully raised three young.

During a severe rainstorm a Robin's nest with two nestlings was blown down. The larger young one survived the fall of 20 feet and was then placed in a Warner Park Bluebird box with three nestlings at about the same stage of plumage development. This Robin was well fed by the Bluebirds, but on the sixth day of its adoption when the fledglings left the nest, it also hopped out although unable to fly and still weak on its legs. The distressed parent Bluebirds were found in a tree near the

nest-box apparently attempting to call it to them from the grassy rut in which it squatted and called. Fearing they might neglect their own young for this helpless Robin, I brought it home and successfully raised it by hand.

In 1939 brooding females in 66 per cent of the 134 nesting attempts were identified. One bird was taken on an unused nest, the others while brooding. From the banding records and recaptures of this group of 67 individuals I obtained additional data on the relative faithfulness of brooding birds to their chosen nest sites. There were recaptured 13 that had been banded in the park in previous years, and 8 of them were occupying the same boxes in which they had been banded. The occupants of Boxes 9 and 22 were using them for the third consecutive year. Nine of them had been banded as nestlings in the park, and 45 were new birds not banded until this year. During the three nesting periods of the season 17 brooding females are known to have used their respective boxes for either two or three nests. A few were found to have moved to boxes in adjoining meadows for subsequent nestings. These moves, however, usually followed an unsuccessful nest.

At my home a female Bluebird (34-172784) banded in April 1936 was found occupying the same box for her fourth year.

As in 1938 no males were found brooding in the park.

On analyzing the nesting data, I found that an egg was laid daily until completion of the set. Apparently incubation started with the laying of the last egg of the clutch. Most broods hatched in 13 or 14 days. In three cases where the entire set proved to be sterile or embryos had perished at an early stage of development, the females incubated 21 days before deserting.

Nestlings remained in the boxes from 14 to 16 days, usually the latter period. Power of flight was well developed by that time. Young leaving the box were observed flying successfully from the entrance to trees at least 100 yards away. Twice, newly hatched nestlings were seen raising the head with wide open mouth even before the natal down had dried.

Reviewing the record of nestlings, I found that of the 521 that apparently fledged successfully in the past three years, 15 females have been found breeding in the park and several males have been seen there, identified by sight as nestlings because they had been banded on the left tarsus. This season 6 females or 2.2 per cent of the 265 nestlings banded in 1938, were found breeding in the park, and there were 3 that had been banded in 1937. If captures of the males had been possible, the percentage probably would have been doubled. Low (1934) found that out of 142 nestlings banded in 1932, 4 birds (2 male, 2 female) or 2.8 per cent returned to nest in 1933.

Two immature Bluebirds which had been banded as nestlings were found dead in the park and one was found three miles north.

At the beginning of each spring season, one or two males have been found dead from injuries in or under Boxes 1 and 2. House Sparrows occasionally attempt to nest in these boxes and doubtless have fought some of the males. However on February 16, 1939, when there were no House Sparrows in the vicinity, we found in an empty box (No. 1) a male Bluebird that had recently died. The dead bird was removed and left on a small stepladder underneath while another box was visited. From a distance it was noted that a male Bluebird repeatedly attacked it, knocking it to the ground and continuing the attack there.

Only four nests were found in the park built in places other than the boxes provided. Two were in a peach tree cavity, one in a stone cavity of an entrance gate post, and the other in a tin newspaper box. These nests, totalling 18 eggs, were 39 per cent successful, yielding only 7 young.

Preparations for the 1940 season have been completed in December, 1939. A few additional boxes have been placed in the adjoining Edwin Warner Park and a number of the less successful boxes in Percy Warner Park have been moved to other locations in a section not previously supplied with boxes. In addition several small boxes have been placed in the wooded sections to attract chickadees, titmice, and wrens. Some experimenting is being done with cat or snake guards. A number of the posts have been equipped with bands of metal that have been cut to have a flaring, fringed edge which it is hoped will deter predators from climbing to the boxes.

Summary

Bluebirds, permanent residents in Tennessee, have long nesting seasons, beginning in February and lasting into September. The seasons are divided into at least three nesting periods.

Early nests have a higher percentage of success than those of later periods; the average number of eggs in a set decreases in each subsequent period; the number of entirely unsuccessful nests also increases in later periods. As the season advances there are increasing numbers of predators robbing nests for food; there are more disturbances due to human activities during summer, causing desertions and disastrously long absences of parents from nests. It is possible that extreme heat affects eggs adversely and also weakens newly hatched chicks.

Five out of 133 sets of eggs were white instead of normally colored.

Boxes placed in suitable open situations are quickly taken. Meadows are favored nest sites. Apparently boxes should be several hundred feet apart to allow sufficient territory for each breeding pair. They should be set out in winter because nest sites are investigated by Bluebirds on mild days throughout the cold season and territorial defense starts in early spring.

Faithfulness to the chosen nest site is a common trait of females and probably of males also. The same site may be used for the entire sea-

son and from year to year unless depredations or other disturbances occur.

Nest boxes placed at a distance from human habitations are more successful than those nearby. Bluebirds are easily disturbed by activities around a home and unlike some species, seldom adapt themselves to noises and movements of a household. Both male and female carry material into the box. Incubation and brooding in all nests is by the female; feeding and caring for the young by both parents. Incubation period usually is 13 to 14 days but occasionally extended to 16 days after laying of the last egg of the set. Young may leave on the fourteenth day after hatching but usually on the sixteenth.

In 1939 Bluebirds used 53 of the 56 available boxes in Percy Warner Park, laying 576 eggs (133 sets), an average of 4.3 per set. From these there matured 290 nestlings, or 50.3 per cent of the number of eggs laid.

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Texas Bird Adventures in the Chisos Mountains and on the Northern Plains. By Herbert Brandt. Bird Research Foundation, 11945 Carlton Road, Cleveland, O., 1940: 5¾ x 8½ in., xi + 192 pp., 16 pls. $3.00.

This is a highly colored account of an excursion which the Texas Game, Fish and Oyster Commission licensed as a scientific expedition. The book is marred by much repetition, by many examples of the pathetic fallacy, and by numerous anthropomorphisms—all expressed in a strangely stilted phraseology. Most of the "discoveries" of which we are told have been published by others in the dozen scientific papers concerning the birds of the region which appeared between 1902 and 1937.

In the field (even if not in this book) the author's romantic imaginings seem to have been contagious. The morning of their start into the mountains "the horses themselves seemed to reflect our human excitement" (p. 55), and by the fourth night even their "soft-spoken rancher guide" on retiring "placed his .45 six-shooter and .30-.30 carbine beside his blankets, so that they could be easily reached if necessary in the night." (p. 103).

In addition to several interesting photographs, there are eleven illustrations by George M. Sutton. Two of the Sutton pictures are pen-and-ink drawings done especially for this book and the others are black and white reproductions of water-color portraits of birds made in the field in the Chisos Mountain region in 1935. In spite of the loss of the color which made the originals so charming, these bird portraits remain very effective interpretations of these species and assure the book a permanent worth.—J. Van Tyne.

THE ACADIAN SHARP-TAILED SPARROWS OF POPHAM BEACH, MAINE

BY WILLIAM MONTAGNA

SINCE the Acadian Sharp-tailed Sparrow, *Ammospiza caudacuta subvirgata* (Dwight), was originally described in 1887, comparatively little work has been done with it.

In June, 1939, I made a collecting trip to Popham Beach, Sagadahoc County, Maine. Popham Beach, which is a part of the town of Phippsburg, is situated at the mouth of the Kennebec River. Acadian Sharp-tailed Sparrows have been known for years to nest in the salt marsh which extends from the mouth of Morse's River to the head of Atkin's Bay. It was in these very marshes that Norton (1927) found and described their nest.

Habits

One of the primary purposes of the trip was to secure some specimens of these birds in fresh spring plumage. Arriving at Popham Beach on June 9, I lost no time in visiting the marsh that afternoon in company with Ralph S. Palmer, who had been at Popham Beach throughout the summer of 1938 and was there for the entire summer of 1939. Although Palmer assured me that the birds must be all around us, we failed, in spite of a laborious search, to see or hear a single Sharp-tailed Sparrow. Early the next morning, however, I returned to the marsh. This time male birds were heard everywhere. Many were engaged in song flights, while others, perched on long blades of grass, sang at short intervals. Beneath some of these song perches were large amounts of droppings indicating that they had been used regularly. Norton (1897 and 1927) made similar observations. On several occasions, shortly after they had been frightened away, male birds returned to their original perch to perform.

The song flight of the males is a peculiar antic which was well described by Dwight (1887): "Sometimes he springs up into the air, particularly towards evening, and setting his wings floats down into the grass fairly gushing with song—such as it is." My observation, however did not agree with Dwight's restriction, "particularly towards evening." H. F. Lewis (1920) has also described this flight song in somewhat more detail. The sparrows I observed at Popham Beach showed little if any tendency to sing in the evening. During the morning hours they performed these antics again and again; often seven or eight males were in the air at the same time, and only a short distance from each other. As noon approached, the performances became less frequent and usually ceased toward the middle of the afternoon. On one occasion a bird was heard singing in the evening. Palmer heard

the birds singing heartily throughout the breeding season, as late as July 25. Singing then diminished, and on August 14, 1938, one last song was heard.

On June 10 two males and one female were collected. The birds had swollen cloacas and the gonads were greatly enlarged. In the female one of the follicles of the ovary was about to burst, and a nearly mature egg was in the oviduct. This female had a large brood-patch, but it was not swollen and watery; evidently the bird was not yet incubating. This specimen was collected after it had flown away from a tangle of three other birds, presumably males, which were crowding over it, attempting to copulate. On June 11 three males were collected with one shot while they were in a curious tangle such as described above. A fourth bird, perhaps a female, flew away unharmed. While going through the marsh I often encountered this peculiar behavior. However, this action was noted only in the morning. At such times the birds were quiet and unaware of one's approach, often flying away only after one had walked within a few feet of them. This habit seems most peculiar, and it may perhaps mean that there are more males than females. I had hoped to collect an even number of males and females, but the number of males taken was much greater. However, females at that time were probably on the nest and difficult to flush.

On June 14 a male descending from the song flight was observed at close range. It alighted not far from me and only one foot away from another bird which I immediately collected. The specimen proved to be a female. Its oviduct contained a full-sized egg and its brood patch was swollen and very watery. On June 15 a male descended from its flight and was seen copulating with another bird. The two were collected and proved to be a pair. The female had one egg with shell in its oviduct and another partly in the shell. Often after the aerial performance the male would join another bird, presumably a female, and together they would fly along the drainage ditches of the marsh. After a short flight they would either engage in copulation or cling to the side of the ditch only a foot or so from each other and a few inches from the level of the tidal water, remaining thus motionless for a considerable time.

Birds were found to be most abundant along the many drainage ditches. These were narrow and often very deep. At low tide the bare sides were exposed, and there the sparrows fed on small aquatic insects. A rough analysis of the crops of specimens collected showed the contents to be exclusively insect matter.

There was no evidence that the males collected had been incubating. Their bellies and breasts were well feathered and showed no indication of a brood-patch. Norton (1897) made similar observations.

These sparrows were unusually quiet, aside from the singing done by the males. Only on rare occasions were they heard uttering soft

notes of alarm. These were short and abrupt and often hardly audible. They could be distinguished with difficulty from the notes of the ubiquitous Savannah Sparrows (*Passerculus sandwichensis*).

Plumage Variation

Our series of twenty-one fresh-plumaged breeding birds, plus five specimens from the same locality, which were borrowed from A. H. Norton, show that there is a considerable range of color variation in this race. The backs may vary from a pale grayish olive without conspicuous whitish streaks to brownish black marked with sharp edges of white (Figure 1). The streaking of the breast and flanks is also variable. These streaks are for the most part only faintly indicated

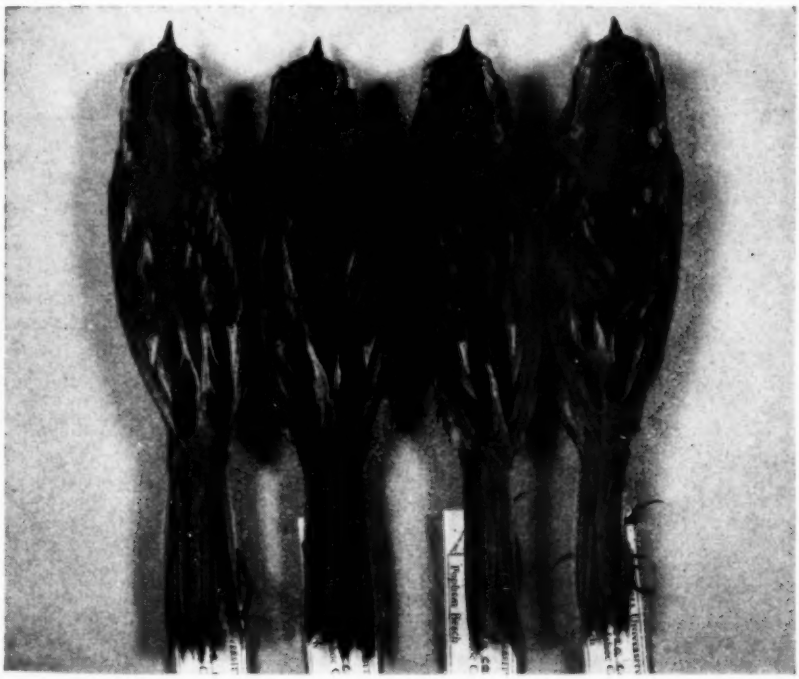

Figure 1. Extremes of dorsal coloration in Acadian Sharp-tailed Sparrows from Popham Beach. (Photograph by Ralph S. Palmer).

by ashy-green markings.[1] However, some of the birds are so sharply marked that they seem to approach *caudacuta*. I am inclined to call these intermediates between *subvirgata* and *caudacuta*. Since the

[1] Such fluctuations of colors occur normally in the races of *Ammospiza caudacuta*. A recently collected series of breeding *A. c. caudacuta* from Tuckerton, Ocean County, New Jersey, shows that the color of the back and head of these birds and the amount of spotting of the breast are quite variable characters.

A.O.U. Checklist and Hellmayr (1938:505) state that *subvirgata* breeds south only to Penobscot Bay, which is about forty miles north of Popham Beach, intermediates are surely to be expected there. A male collected on June 11 (W.M. No. 407) has the tawny breast-band sharply streaked with dark brown, and the markings of the flanks are too heavy for typical *subvirgata*, which has obsolete streaks (Figure 2).

On the morning of June 25 I collected a female which was unusually bright about the head and had well-defined streaks on breast and flanks. On comparing this specimen with material borrowed from the American Museum of Natural History (specimens from Dwight's own

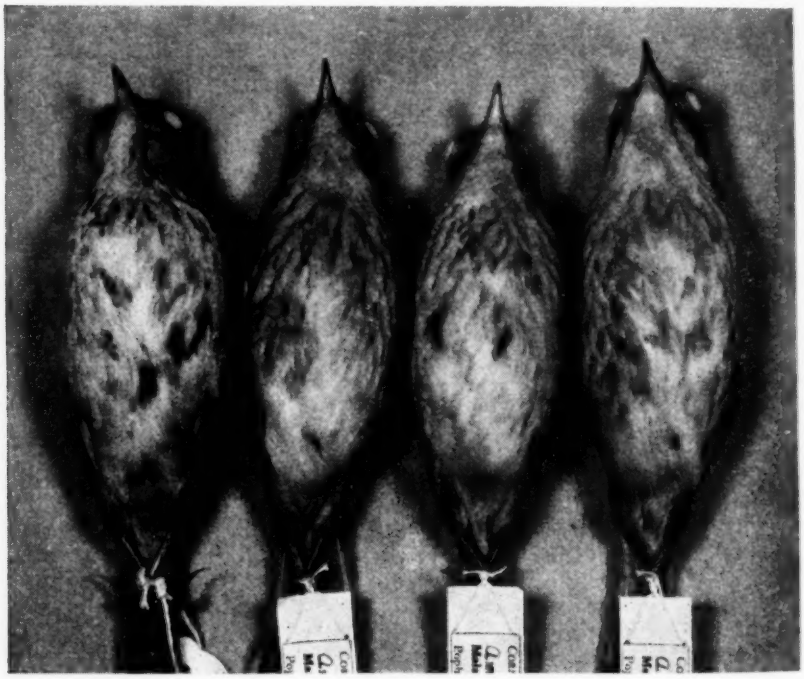

Figure 2. Sharp-tailed Sparrows from Popham Beach. *Ammospiza c. caudacuta* on left; *A. c. subvirgata* on right; two intermediate specimens in center. (Photograph by Ralph S. Palmer).

collection) I found that the bird is unmistakably *A. c. caudacuta* (Gmelin).[2] Finding this bird in the middle of a colony of *subvirgata*

[2] Popham Beach is about 35 miles northeast of Scarborough, the bird's previous northernmost range. Dwight writes, "*Ammodramus caudacutus* is restricted in the breeding season to the salt marshes of the Atlantic coast from Virginia to Massachusetts. North of the latter named State, in the limited marshes of New Hampshire and Maine coasts, it is probable that *subvirgatus* would be found. . . . It is obvious therefore that breeding specimens from the Maine coast are greatly to be desired." (Dwight,

is interesting, for it seems probable that the bird was mated with a male of this race. The specimen was unquestionably in breeding condition since the ovary was greatly enlarged and the brood-patch was swollen.

This bird adds more evidence in support of the belief that some of the specimens of *subvirgata* from Popham Beach, although not all, are intermediates. There is little chance that the identity of the specimen is mistaken, for, as Dwight writes, ". . . the palest streaked *caudacutus* in any plumage may be recognized at a glance by being more streaked than any specimen of *subvirgatus*." (Dwight, 1887: 235.)

In describing the female of *subvirgata*, Dwight (1887:234) writes, "Resembling closely the male, but with richer yellow-buff, orange tinged across the jugulum and about the head and with secondaries, tertials and wing-coverts conspicuously edged with pale russet instead of grayish." Of the four females I collected on June 11, 14, and 15, two are richly colored with orange-buff about the head, particularly the superciliary and malar stripe, while the other two are dull by contrast. Moreover, males collected on June 10, 11, 14, and 15 are, as a series, as bright as the females. The jugulum is even more highly colored in the males. The four females have, as do the males, the tertiaries definitely margined with white; this character may vary in the males from a definite broad, white margin to a faint, indistinguishable one. The secondaries have a russet margin in the males as well as in the females. The wing-coverts of either sex may or may not have a narrow edge of gray. It must be remembered that the above descriptive remarks are based on birds which appear normal in color. Intermediates were not included. Apparently there is no difference in color between the males and females.

Measurements of the bill, tail, wing, and tarsus show that on the whole males average larger.

TABLE 1

MEASUREMENTS IN GRAMS AND MILLIMETERS OF SHARP-TAILED SPARROWS FROM POPHAM BEACH

	Weight	Wing	Tail	Bill	Tarsus
Males (21 birds)	17.4–20.9 (18.3)	57–60 (59.4)	49.5–53.9 (51.6)	8–8.5 (8.7)	20–24 (21.9)
Females (5 birds)	16.4–21.2 (18.1)	52.5–56.5 (55.1)	46–49 (48)	8.5–9.1 (8.8)	19.5–22 (20.7)

All of the birds collected were weighed carefully before being prepared. The weights of the sexes are nearly alike. The males average only 0.2 grams heavier. However, the number of females collected is

1896:275.) Norton says, "Though search has now been made, it has not been found farther to the northward than Scarboro, Maine, and the physical structures of the coast are such as to suggest the improbability of the normal range extending beyond this town." (Norton, 1897:99).

smaller than that of the males, and it is probable that an even number of specimens might give different results. Also, most of these females contained large eggs, and this unquestionably made their average heavier.

Among the specimens borrowed for comparison from the American Museum of Natural History, one female from Dwight's own collection is marked "Like Type." This is a fall specimen, while Dwight's type was a July bird. However, reading the original description, one has the impression that a fall bird is being described, since at that time the "Tertials, secondaries and wing-coverts" are "russet, edged like the female in breeding dress." (Dwight, 1887: 234.)

Six males, collected on June 25, had already become very worn in plumage. Their whole aspect is different from that of the birds collected ten days before. The amount of white on the tertiaries is reduced considerably. On July 25, 1938, Palmer collected a series of five males and one female. The plumage of these birds is so abraded that the tertiaries, scapulars, and back feathers no longer have white edges. The birds are brown-backed; even the greenness, which is so typical of fresh *subvirgata*, is almost entirely lost.

Summary

Acadian Sharp-tailed Sparrows were observed singing only during the morning hours; in the afternoon they were quiet and inconspicuous.

Male birds, as many as three, were seen crowding over one female, perhaps attempting to copulate. This may mean that either the population of unmated males was greater than that of available females or that the males had polygamous tendencies. Repeatedly birds were seen copulating immediately after the male's descent from the song flight.

One breeding female *A. c. caudacuta* was taken in a colony of *subvirgata*. Some of the specimens collected prove to be intermediates between *caudacuta* and *subvirgata*.

There is no difference of coloration between the sexes. Plumage variation is described.

The males, although only slightly heavier, average larger in linear measurements than females.

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BIRDS OF OREGON. By Ira N. Gabrielson and Stanley G. Jewett. Published by Oregon State College, Corvallis, Oregon, 1940: 6 x 9 in., xxx + 650 pp., 97 pls., 20 figs. in text (maps), colored frontispiece, folded life-zone map. $4.25.

This book fills a long-standing need for a comprehensive treatment of the birds of Oregon. It is the first general book on the ornithology of that state and as such is admirably complete. Through long experience in the field, the authors are especially well qualified to discuss occurrence, abundance, and habits of species. It is explained in the introduction that the text was written entirely by Gabrielson, but (importantly) a large part of the endless task of checking records and literature was assumed by Jewett.

The illustrations form a prominent part of the work. Besides the colored frontispiece by O. J. Murie, they consist chiefly of high grade photographs by William L. Finley, H. T. Bohlman, Alex Walker, Reed Ferris, and the authors. The scientific value of these would have been increased if localities and dates on which they were taken had been included in the legends. Small maps, run as text figures, assist to clarify distribution of races in certain geographically variable species. The life-zone map is that worked out by Vernon Bailey for his "Mammals of Oregon."

An introductory section of 19 pages is entitled "Something About Birds as a Group." This necessarily sketchy survey is intended for the beginning student. Helpful, and more complete sections on topography and life-zones, and on the history of ornithology in Oregon follow.

As regards systematics, the book is decidedly conservative. It is evident that there is no attempt at systematic revision, although there is much new information about the distribution of races accepted by the A.O.U. Check-list of 1931. Thus, none of the many subspecies described by Oberholser in 1932 from the Warner Valley area are accounted for, except that they are included with the list of birds with type localities in Oregon. Records of distribution are as a rule not included if of date later than 1935, when the manuscript was completed. For example, Jewett's own record (*Condor*, 41, 1939: 85) of the Black Pigeon Hawk in summer at Paulina Lake, east of the Cascade Mountains is not mentioned.

Each species account begins with a description quoted from Mrs. Bailey's "Handbook of Birds of the Western United States." This is followed by a paragraph on distribution, first giving the general distribution, a useful feature, and then that for Oregon. The body of the account includes, in running style, statements about the history of first discovery of the bird in the state, seasonal status, abundance, habitat, nesting, food, and habits as observed in Oregon. Repeated use of the book has convinced the reviewer of its dependability and worth as a reference on distributional matters and as a source for items on natural history. —ALDEN H. MILLER.

WINTER BANDING OF OKLAHOMA CROWS[1]

BY E. R. KALMBACH AND S. E. ALDOUS

IT SOMETIMES happens that unexpected by-products or minor aspects of investigative work become as important as the principal results. These may have direct application to the problem undergoing study or they may have a bearing on some related matter that has long been in need of an answer. Such was the case with an "unscheduled" Crow-banding enterprise carried out by the junior author while engaged in conducting experiments in the control of Crows (*Corvus brachyrhynchos*) in Oklahoma during the winter of 1935–36.

The experimental work in Crow control consisted, among other things, of an appraisal of trapping as a control measure (Aldous, 1936). Several traps of the "Australian" type having lateral dimensions of 10 to 12 feet were constructed.[2] When baited with carrion and properly attended to, these were capable of retaining alive large numbers, and under favorable conditions, were useful in reducing local Crow populations.

Despite a strenuous demand on the part of local farmers and sportsmen that all Crows caught should have their necks wrung, an appreciable number (714) were banded and released. The returns from these have contributed new information on Crow movements in and out of Oklahoma. Not only do these data have a direct bearing on problems associated with crop damage but, what is of equal importance, they show the relation of winter Crow control in Oklahoma to the welfare of the upland game and insectivorous birds in that state and the waterfowl that breed to the north. It is this "by-product" of the Crow control studies that furnishes the subject matter of this paper.

Banding Procedure

In the course of the Crow control work one trap was built and operated near Chickasha in Grady County and three others near Norman in Cleveland County. All the birds caught in the Norman traps were released in that vicinity, but most of those caught at Chickasha were removed to distant points where they would be less likely to become victims of certain other control experiments that were being carried out in that area. Accordingly, of the 714 crows banded, 486 were released near Norman, 95 near Oklahoma City, 48 near Chickasha, 35 near Shawnee, 34 near Ardmore, and 16 near Tabler. Oklahoma City, the most northerly of these points, is about 124 miles

[1] A brief discussion of the results obtained from a part of these returns (125) appeared in a revised edition of U. S. Department of Agriculture Farmers' Bulletin 1102, issued in June 1939.

[2] Those interested will find a description and drawings of an "Australian" Crow trap in *Wildlife Research and Management Leaflet BS-27*, entitled "A Cage Trap Useful in the Control of White-necked Ravens." Copies of this leaflet may be obtained on request from the Fish and Wildlife Service, Department of the Interior, Washington, D. C.

north of Ardmore, the most southerly point of release; while Shawnee, the most easterly point, is about 61 miles east and a little north of Chickasha, the point of origin of all transported birds.

Banding started on December 5, 1935, and was conducted at intervals until March 10, 1936, when 11 Crows constituted the final catch. During that period 21 groups of Crows were banded and released, the catches ranging from a few birds to 177 captured at Norman on January 27. Notwithstanding the fact that release of the birds extended over an appreciable period (more than 3 months), the recapture of individual Crows strongly indicated that this group of birds was quite sedentary during the banding period. Of the 486 Crows banded at Norman, 2 reentered a trap 7 times; 4, 5 times; 4, 4 times; 9, 3 times; 16, 2 times, and 75, once. Subsequent returns from the banded Crows further emphasize the relatively stationary nature of these birds during the winter. Consequently, despite the extended banding period and the release of birds at several points, returns from the birds may be discussed to advantage as having originated with a definite group of wintering birds. This idea is embodied in the map (Figure 1) on which the focal point of the radiating lines indicating movement is registered at Norman, Okla., where about 68 per cent of the banded birds were released. In computing the distances traveled by the birds (a subject discussed later), measurements were made from the exact point of release.

Returns

From the 714 Crows banded, 143 returns have so far been received. Figure 1 presents, in addition to the points of recovery, a general indication of the season of the year during which the birds were killed. Recoveries represented by the larger black dots are those made between the first of April and the end of August, a period that may be looked upon as the breeding and rearing season of bird life generally in North America and the period in which problems of Crow predation might arise. The smaller circles mark recoveries made between the first of September and the end of March, a time of year not generally associated with Crow depredations on other birds.

Of the 65 Crows recovered during the breeding and rearing season (April 1 to August 31), 49 (75 per cent) were killed in the Prairie Provinces of Canada. The dates and localities of numerous other returns recorded in the states north of Oklahoma (some indicated by black dots and others by circles) give evidence of the fact that many others of this group of wintering Oklahoma Crows may also have been on their way to or from Canadian breeding grounds when they were killed.

The grouping of the black dots in the southern part of the Prairie Provinces lends statistical evidence of a state of affairs frequently observed by field ornithologists working in that region, namely, the

dense concentration of nesting Crows close to the northern border of agriculture. The shaded area in the northern part of the map indicates, roughly, the coniferous forest region which Crows do not enter in great numbers. When they do appear, it is usually in the vicinity of clearings and settled areas where a semblance of their commonly preferred environment may be found.

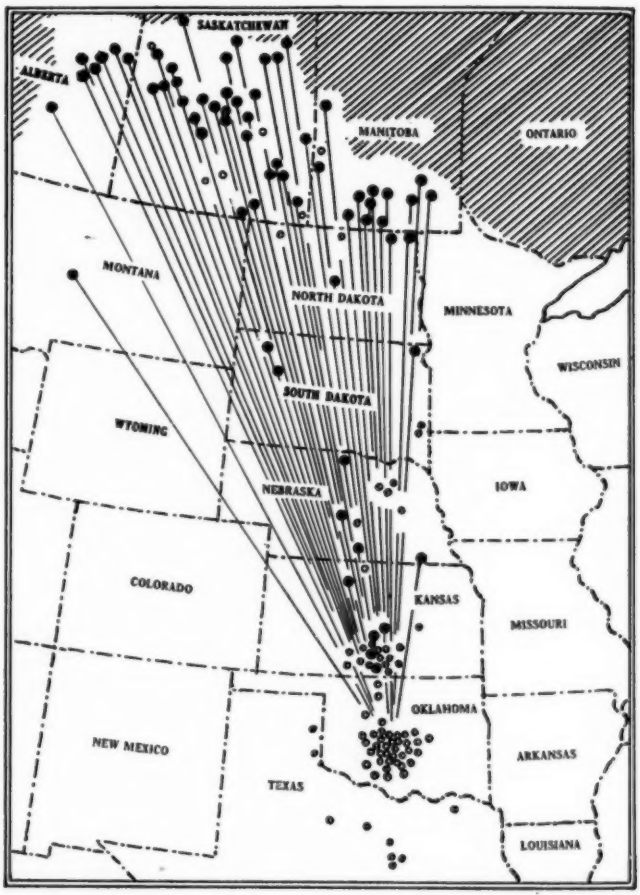

Figure 1. Map showing the recovery points of 143 to 714 Crows banded and released in south-central Oklahoma during the winter of 1935–36. The black dots indicate recoveries made between April 1 and the end of August; the smaller circles, between September 1 and the end of March.

Of the 7 recoveries from Alberta, the most northwesterly one was recorded near Camrose, southeast of Edmonton. This bird had traveled about 1,435 miles from its point of release at Norman, Okla. Another, shot near Strathmore, Alberta, had traveled westwardly through

16 degrees of longitude, and its point of recovery is on a meridian that, southwardly, passes west of Great Salt Lake, Utah. Of the 35 retrieved in Saskatchewan, 30 were recovered during spring and summer and the remaining 5 were shot in the fall, indicating that some of these birds are late in leaving their breeding ground. The most northerly of all these returns is that of a Crow shot at Meadow Lake, Saskatchewan, a point due west of Prince Albert Park at nearly 54° north latitude and fully 350 miles north of the Canadian border. This bird, which had been released at Ardmore, Okla., had traveled about 1,480 miles from its winter home, the longest migration recorded for any of these Oklahoma Crows. Several others, traveling nearly as far, were recovered at points east and southeast of Prince Albert. All but one of the 13 recoveries made in Manitoba were recorded in spring and summer. This group includes the most eastwardly of the Canadian returns; yet the most easterly one is that of a Crow shot at Beauséjour, northeast of Winnipeg, a little more than one degree of longitude east of the point of banding. Besides the pronounced northerly migration of these Crows to their breeding grounds near the limits of agriculture, it is evident that there is a definite drift to the west, a tendency also shown by many other species of migratory birds traversing this plains area.

Of the returns from states north of Oklahoma, mention may be made of the single bird shot at White Sulphur Springs, Montana, the most westerly point within the United States at which one of these Crows was collected. The bird was taken in the middle of June and probably was breeding in the vicinity. Three of the 5 Crows recovered in North Dakota were collected in the breeding season, and the other two, shot in the fall, may have been on their way south from northerly points. Of the 5 collected in South Dakota, one each was taken in April, May, and June and may have been local breeders; one was collected in March, and the fifth in December, apparently a late traveler from the north. Of the 9 collected in Nebraska, 5 were taken during fall, winter, or early spring, 3 in April, and one in May. Of the 21 Crows recovered in Kansas, 16 were shot in the nonbreeding season and only 5 during April, May, and June.

It will be noted that of the 143 returns recorded *not one was recovered in the state of Oklahoma during the "breeding and rearing season."* The 38 Crows recovered in that state were collected between the third of November and the end of March. Twenty-two of these were taken early in the spring following their banding (1936); some of the others survived as long as 3½ years. It is likely that many of these Crows captured in Oklahoma during winters subsequent to the one in which they were banded had made journeys to the north to breed. A similar statement may be made regarding the 9 wintering Crows collected in Texas, each one of which had lived through at least one breeding season between the time of banding and its recovery. That these birds

had bred in the north and on subsequent southward journeys had passed beyond the vicinity of their banding is a plausible assumption.

The period and the extent of migration of these Oklahoma birds are revealed by the average distances traveled by the birds recovered in the respective months. These data are set forth in Table 1. In addition to information on the distances traveled, note is made of the number of returns and the states in which the birds were collected.

TABLE 1

RETURNS OF BANDED CROWS LISTED BY MONTHS, THE AVERAGE DISTANCE TRAVELED BY EACH MONTHLY GROUP, AND THE STATES IN WHICH THE RECOVERIES WERE MADE

Month	Number of returns	Average distance in miles from point of release	Locality of recoveries by states
January	13	97	Oklahoma, 8; Kansas, 2; Texas, 2; Nebraska, 1.
February	18	98	Oklahoma, 10; Kansas, 4; Texas, 4.
March	27	210	Oklahoma, 13; Kansas, 7; Texas, 1; Nebraska, 4; South Dakota, 1; Manitoba, 1.
April	16	940	Kansas, 2; Nebraska, 3; South Dakota, 1; Saskatchewan, 7; Manitoba, 1; Alberta, 2.
May	21	1,046	Kansas, 1; Nebraska, 1; South Dakota, 1; North Dakota, 2; Manitoba, 4; Saskatchewan, 11; Alberta, 1.
June	23	1,055	Kansas, 2; South Dakota, 1; North Dakota, 1; Montana, 1; Manitoba, 5; Saskatchewan, 11; Alberta, 2.
July	5	1,234	Manitoba, 2; Saskatchewan, 1; Alberta, 2.
August	0	No data	No returns.
September	4	1,123	North Dakota, 1; Saskatchewan, 3.
October	2	973	North Dakota, 1; Saskatchewan, 1.
November	3	67	Oklahoma, 3.
December	11	264	Oklahoma, 4; Texas, 2; Kansas, 3; South Dakota, 1; Saskatchewan, 1.

SEASONAL DISTRIBUTION OF RETURNS

During the years covered by these returns the general northward exodus from Oklahoma, as indicated both by the average mileage traveled and by the states in which the birds were recovered, takes place before April 1. Even at that date one bird had reached Manitoba. Before the end of April, 10 of the 16 birds recovered during that month had found their way into Canada, and the average distance traveled by all the birds recovered in April was great enough to extend from the point of release to beyond the Canadian border. Because of the limited number of returns, the southward movement of the birds is not so clearly set forth. Although these banding data do not disclose

the fact, field observation indicates a marked influx of Crows into Oklahoma in October. The returns do show, however, the presence of the birds in that state in November and December. In the latter month returns were received not only from the winter Crow range in Kansas, Oklahoma, and Texas, but also one from South Dakota and another from Saskatchewan.

The paucity of recovery records for the second half of the calendar year is at present unexplained. Despite the increase in shooting that one might expect in October and November, the returns for the six months, July to December, inclusive, were materially less than for the first six months in *each* of the three years for which there are complete data. The returns for each of these years, given in semiannual totals, are as follows: 1936, 56 and 20; 1937, 44 and 3; and 1938, 10 and 2. At the time of this writing, returns for 1939 are available for only the first 6 months, a total of 8.

Mortality Rates

The rapid decrease in the number of returns during the years following the release of the birds gives evidence of the gun pressure under which these birds exist. The yearly totals of 76, 47, 12, and 8 (first 6 months) for the years 1936 to 1939, inclusive, lead one to believe that relatively few of these birds live more than four years in this plains area where they are subject to gunfire throughout their migration route and on their breeding grounds and to the devastating toll of bombing while in their winter roosts in Oklahoma. In the 3½ years immediately following the release of the 714 banded Crows, 143, or slightly more than 20 per cent, of them have been reported killed. The returns for the calendar year immediately following banding amounted to about 10.5 per cent of the birds banded, a percentage somewhat less than that of the returns usually obtained from waterfowl shot during the first season following banding. It is possible that the number of returns for these Crows might have been greater were it not for the fact that, in their winter home, many are killed in bombings under conditions not conducive to the recovery of bands.

Discussion

If the 143 returns so far obtained from the banding of 714 wintering Crows in Oklahoma reflect the general habits of the species in that state, it is evident that problems of control or management of this bird must be approached with the realization that it is highly migratory. Wintering individuals quite evidently are not summer residents. They are, however, breeders far to the north, many of them raising their young in the Prairie Provinces of Canada where there appears to be a concentration close to the northern border of agriculture. There also is evidence that those birds that survive the migration to and from the

breeding grounds will return to the general area of the previous winter's sojourn.

On these premises certain deductions may be made having a bearing on the economics of the Crow in Oklahoma and on the merits of Crow control in that state.

Considering first the matter of Crow control for the protection of late-maturing crops, particularly grain sorghums, it is logical to conclude that a reduction in the number of Crows from November to the end of March would have its effect on the individuals that not only are present throughout this period but which, if they survived, would return to the state in subsequent winters. Without attempting at this time to pass on the economy of winter Crow control for crop protection in Oklahoma, there is little question but that such control will have both immediate and later effects on the particular individuals concerned with these depredations. Whether the progeny of surviving individuals take the same migratory route as that of the adults and help swell the numbers frequenting winter roosts could not be determined by this banding program. If such is the case, the benefits of winter control for the purpose of crop protection may have even more far-reaching effects.

Crow control for the benefit of upland game or insectivorous birds often is advocated. According to the evidence brought forth in this banding work, a winter campaign of Crow control in Oklahoma would have little or no effect on the welfare of these groups of birds breeding and raising their young in that state. Not one of the winter-banded Crows was recovered in Oklahoma between April 1 and August 31; this clearly indicates, when considered in connection with the localities of the returns obtained during the breeding season, that the winter Crows of Oklahoma are not its summer corvine residents. That the summer Crows of Oklahoma may be the winter residents of Texas seems a plausible assumption. In that event, winter Crow control in the latter state would have some effect on the relatively sparse summer Crow population of Oklahoma, although the preponderant population of Texas Crow roosts is likely also to be comprised of more northerly raised birds.

The control of Crows in Oklahoma during the winter is often considered a conservation measure by reason of benefits accruing to waterfowl nesting far to the north. These banding records have definitely shown that many (possibly a great majority) of the winter Crows of Oklahoma do nest and spend the spring and summer months in close proximity to the northern border of agriculture where, in favorable environments, waterfowl still are common nesters. Kalmbach earlier came to the conclusion that in this relatively narrow strip the Crow is a hazard of marked importance to nesting waterfowl even though the continental aspects of Crow pressure on the duck supply may not

be so alarming (Kalmbach, 1937). In referring to the merits of Crow control at winter roosts to the south aimed to improve waterfowl conditions farther north, he ventured to remark (page 35) that the benefits "are, in turn, less direct, since only a part of the birds present at these roosts (number at present unknown) actually enter the problem of Crow-waterfowl relationships on the breeding grounds." By that is meant that, although Crows are exceedingly abundant in the pothole and lake country at the border of agriculture, many of them in that very area, live in and obtain food from agricultural environments. What part of the Canadian Crows are pursuing the role of persistent duck-egg stealers and what have habits not greatly different from those of Crows in this country is not known. In any event control in Oklahoma would have its effect spread over the Crow population of a wide area in the southern part of the Prairie Provinces, an effect that would be diluted not only by the extent of the area, but also by the fact that only a part of the Crows nesting therein enter the problem of Crow-waterfowl relationships. In the light of these considerations and in view of the even more impelling fact that Crows in destructive abundance are present on possibly only a sixth of the duck-nesting area of Canada and Alaska, Crow control in the roosts of Oklahoma must be looked upon as having possible benefits to a part of the waterfowl in one, the central, flyway; its effect on the continental supply of waterfowl must be greatly discounted.

These, briefly, are the points of discussion most likely to arise from a consideration of the data obtained from this banding project. There are, however, others and, lest they be entirely overlooked, let it be remembered that in western Canada, where Indian corn is displaced largely by small grains, where there are no late-maturing sorghums to be attacked, where Crows are present mainly during the seasonal period of insect prevalence, and where little is seen of the enormous gatherings that characterize its winter home, the Crow presents a markedly different economic problem. Much is heard among certain groups of the Crow's depredations on other bird life; there are many others, however, who have observed and are grateful for the work done by the Crow on insect life. They, too, have an interest in control policies aimed to administer wildlife so as to render the greatest good to the greatest number. Of all those directly concerned they in fact may be the most vitally involved.

Strange though it may seem, there are, even in Oklahoma, certain sections grown largely to wheat and oats where Crow control is not considered a pressing problem.

Summary

The banding of 714 Crows in south central Oklahoma during the winter of 1935–36 has yielded, during the three and one-half years

following their release, 143 returns, slightly more than 20 per cent of the birds banded.

Analysis of these returns shows that, of the 65 Crows recovered during the breeding and rearing season (April 1 to August 31), 49 (75 per cent) were killed in the Prairie Provinces of Canada. The dates and locations of numerous other returns recorded in the states north of Oklahoma indicate that many others of this group of Crows may have been on their way to or from Canadian breeding grounds. During this same period of the year not one of the winter-banded Crows was recovered in Oklahoma, clearly indicating that winter Crow control in Oklahoma can have little or no effect on nesting upland game or insectivorous birds of that state.

Although winter Crow control in Oklahoma is destined to remove some birds that would enter the problem of Crow-waterfowl relationships in the Canadian provinces, the effect of this control is certain to be much "diluted" if the results are to be judged in a continental perspective. This comes about because only a portion of the Crows nesting in Canada can be classed as duck-egg predators, and because the Crow, in what might be termed destructive abundance, occupies possibly only a sixth of the duck-nesting area of Canada and Alaska.

As a protective measure for late-maturing crops, particularly grain sorghums, winter Crow control in Oklahoma may be looked upon as fairly selective with respect to the removal of the very individuals involved in these depredations. Not only is this winter population quite sedentary during that season but the banding returns have shown that birds which survive are likely to return to the same general region in subsequent winters.

The rapid decrease in the number of recoveries noted in successive years following banding leads to the belief that relatively few of these birds live for more than 4 years in this plains area where they are subject to gunfire throughout their migration route and on their breeding ground and to the severe toll of bombing in their winter roosts in Oklahoma.

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Fish and Wildlife Service, U. S. Department of the Interior, Denver, Colorado and St. Paul, Minnesota

GENERAL NOTES

Notes on Nesting Habits of the American Bittern.—On May 2 at 5:00 P.M., the writer accidentally flushed an American Bittern (*Botaurus lentiginosus*) from its nest in a wet meadow of cord grass (*Spartina pectinata*) 7 miles north of St. Paul, Minnesota. At that time there were two warm eggs in the nest. In the afternoon of May 12, my field partner found another American Bittern nest containing four warm eggs. This nest was only 150 feet from the one first discovered. Both nests were in the same five-acre meadow of cord grass, and they hatched successfully on the same day. In spite of the proximity of the two nests, there was no evidence of strife between the adults during the period of incubation and care of the young in the nests. Both Bent (*U. S. Nat. Mus. Bull. No.* 135, 1926:75) and Forbush (Birds of Mass. and Other New England States, 1, 1925:321) comment on the fact that several Bittern nests may be found in a small meadow, and Forbush implies that this may be a suggestion of the gregariousness so characteristic of the nesting habits of other herons.

The nests were placed directly on the ground, and they consisted of a platform of loosely gathered cord grass. The nests were shallow and measured ten inches in diameter. They were elevated only 3 or 4 inches, and were placed in good patches of cover formed by dead cord grass and three-foot willows. Concealment from above was fair. The nearest open water was 200 feet from the nest first discovered and 350 feet from the other. The meadow which was chosen for the nesting sites was surrounded by low, sloping hills that supported a medium growth of oak. Each nest was approximately 150 feet from the closest break in cover type between the meadow and the base of the timbered hills.

The adults did not flush from either nest until we were within 2 or 3 yards. Both the eggs and the nesting sites had been considerably fouled by the excrement of the adults. However, there was no wasted or uneaten food in or around the nests. Egg shells and infertile eggs were not removed from the nests after hatching.

F. L. Burns (*Wils. Bull.*, 27, 1915:282) and Bent (*loc. cit.*) placed the incubation period at 28 days, but Mousley (*Wils. Bull.*, 51, 1939:83–5) found it to be 24 days, and my data confirms this.

On May 2 at 5:00 P.M., there were two warm eggs in the nest first discovered. On my next visit, May 4 at 11:45 A.M., the adult was flushed and 4 warm eggs were found in the clutch. On May 12 the nest was intact, and 35 minutes after flushing the adult had still not returned to the nest. On May 16 both nests were intact, and on May 26, 2 young were found in each nest. In the nest first discovered one of the young was thoroughly dried and the second, which was wet, had apparently just emerged from the shell. In fact, the mucous membrane in the egg shell was still moist. In the other nest one of the young was completely dried and the other was partially so. One of the eggs was noticeably pipped.

On June 6 there were three young Bitterns in each nest. Since the young hatched on different days, and the eggs were deposited on successive days, incubation presumably started with the deposition of the first egg. From the (assumed) deposition of the first egg on May 1 to the hatching of the first bird on May 25 is an incubation of 24 days. The fourth egg in each nest was infertile.

On June 6 both nests were visited. In the nest first discovered, the two larger young crawled from the nest and attempted to hide in the cord grass, but the third and smaller one was inclined to remain in the nest. In the other nest the three were all of the same size, and when approached, they left the nest and attempted to escape in the dead cord grass. By June 8 all young had left both nests, having remained in the nests for about 13 days. This checks closely with the period of "two weeks" reported by Bent (*loc. cit.*)

Although this swamp was hunted over regularly by a male Marsh Hawk (*Circus hudsonius*), the Bittern nest was never disturbed.—David B. Vesall, *Carlos Avery Nursery, Forest Lake, Minnesota.*

A Suggestion Concerning Territorialism In Tapera naevia.—So little is known of the breeding habits of *Tapera naevia,* the only Western Hemisphere cuckoo proven to be parasitic, that it seems desirable to record fragmentary yet suggestive observations concerning the territorialism of the species. Present knowledge of the breeding habits is summarized by Friedmann (*Ibis,* 1933:532–9). To these records of the hosts I wish to add that on Dec. 27, 1939 near Santa Elena, Entre Rios, Argentina, I found a young *Tapera* in the nest of the Oven-bird, *Schoeniophylax phryganophila.* In addition there were two young and three eggs of the host ready to hatch. The *Tapera* had probably hatched about two days before the others.

In the vicinity of Santa Elena the species is abundant, and although seldom seen, is conspicuous because of its loud, persistent call. About the first of November the birds begin to repeat their monotonous two-syllabled note "crespín," frequently calling throughout the night. Each bird calls from one circumscribed locality and remains there for a long time. Four birds, presumably the same although not marked for identification, called for a month, each from its own limited area. This habit of calling from one location is also known to all the natives and may be considered a universal behavior. Friedmann (*loc. cit.*) states that both sexes call and proved that the female calls by collecting one in the act. The sex ratio of the species is not known. The fact that in museum collections there are many more males than females (74 to 28) may be interpreted to indicate that the male calls more frequently and thus is more frequently collected or that there really exists a surplus of males in the population. This latter condition is the more likely since a species with abnormal breeding habits usually has an abnormal sex ratio (Mayr; *Amer. Nat.,* 73, 1939:156–79).

The fact that *Tapera* calls persistently from one circumscribed area is of great importance in relation to the territorialism of the Cuculidae. In order to ascertain the sex of the bird calling from one definite spot I tried unsuccessfully for three weeks to collect one of the four calling birds but their wariness and ventriloquial ability always outwitted me. For *Cuculus canorus* it is known (Makatsch, 1937, Der Brutparasitismus der Kuckucksvogel) that each female has a definite territory and also that the males live in a more or less limited area. Molnar (*Aquila,* 1939: 257–64) reports that each female has a territory but mates with several males. However, at times other females lay eggs in this territory. In the parasitic African Cuckoos, Friedmann (*Auk,* 45, 1928:33–8) finds that, although two species have weak territorial instincts, several species establish definite territories which are dependent upon available nests to be parasitized. The male is more faithful to the territory than the female. Thus the habit of maintaining one definite area occurs in two subfamilies (Cuculinae and Geococcyginae) which are widely separated geographically and taxonomically.

In terms of the phylogeny of the Cuculidae there are two possible interpretations of the development of territorialism. Either the habit of maintaining a territory has developed independently in the Cuculinae and the Geococcyginae (the subfamily to which *Tapera* belongs) or the Geococcyginae are descended from a cuculine stock which had already developed territorialism. If this latter interpretation is correct, then, since many members of both subfamilies are non-parasitic, it is necessary to conclude that territorialism developed in the group prior to parasitism and also before the family spread to the western hemisphere.—David E. Davis, *Sheldon Traveling Fellow, 1939–40, Harvard University, Cambridge, Massachusetts.*

The Arctic Three-toed Woodpecker as a Breeding Bird in Wisconsin.—The nesting of the Arctic Three-toed Woodpecker (*Picoides arcticus*) has been considered probable but indefinite for Michigan (Josselyn Van Tyne, Check List of the Birds of Michigan, 1938) and for Wisconsin (A. C. Bent, Life Histories of North American Woodpeckers, 1939). A. J. Schoenebeck (Birds of Oconto County, 1902) states: "In the year of 1893 Capt. B. F. Goss and myself found two nests of this bird, both containing young birds." Under date of September 28, 1937, E. R. Ford wrote to me that The Chicago Academy of Sciences has a set of four eggs of the above species taken by A. J. Schoenebeck in Oconto County, Wisconsin, May 16, 1894. The data read: "Incubation just begun, nest in hollow in pine tree excavated by bird six feet up, near edge of deep pine woods."—A. W. Schorger, *168 North Prospect Avenue, Madison, Wisconsin.*

Injured Birds as a Possible Source of Unusual Records.—A Snow Bunting (*Plectrophenax nivalis*) with a broken wing was picked up near Fargo, North Dakota on January 6, 1939, by Roy Humphreys, Jr. The break seemed to be close to the bird's body and impossible to treat. The bird thrived on a diet of commercial bird seed and most of the time had the liberty of a screened porch. It recovered the use of the wing and on March 5 Roy released it after I had banded it.

A Lapland Longspur (*Calcarius lapponicus*) picked up by school children late in March, 1939, was not so fortunate. The bird was cared for by Mrs. H. M. Sherwin, but did not recover the use of its wing. Late in the spring it was released on the grounds of the Camp Fire summer camp, ten miles south of Detroit Lakes, Minnesota. This at once suggested that if such a bird happened to be collected, it might be in breeding condition and become an unusual record. There must be many birds thus left behind during migration.

On May 20, 1940, I banded a Slate-colored Junco (*Junco hyemalis*). When released, the bird flew rather weakly and somewhat to one side as if one wing were weak. It was very probably this bird which I had seen on May 16, the only one noted since May 4, which is about the normal time for the last of the species in this locality. This was apparently an individual which had been injured and unable to migrate with the rest. If delayed for some time it might fail to leave, or what seems more probable, drop out at some other point on its northward journey because of its wing condition.

Another instance of somewhat different character seems worthy of mention. On October 22, 1939, I trapped and banded a Harris Sparrow (*Zonotrichia querula*) which had lost all of the flight feathers except the outermost primary in the left wing. New feathers were already breaking the sheaths, so the accident must have occurred some days earlier. The bird was takn at a place where a trap had just been set about ten rods from the others. Three days later the bird appeared at the other traps, quite unable to fly when released. On October 26 the new feathers projected about one-half inch beyond the sheaths. On October 28 they had reached a length of an inch and the bird was able to lift itself a foot or more above the ground for a couple of rods. On October 31 the feathers had attained one and one-fourth inches and the bird was flying quite well. Another quarter inch growth was recorded November 3 and the wing seemed practically normal. On the following day the bird was taken only once but a Harris Sparrow was quite voluble in the bushes that evening. It was not seen again and probably departed that night. No other individual of the species had been taken since October 21.—O. A. Stevens, *Fargo, North Dakota.*

EDITORIAL

The Twenty-sixth Annual Meeting of the Wilson Ornithological Club will be held in Minneapolis on November 22 and 23. Headquarters will be at the Minnesota Museum of Natural History on the University of Minnesota main campus. The newly-finished museum is an attractive building with all facilities needed for such a meeting. Adjoining the museum is the new building known as the "Center for Continuation Study" which includes living and dining quarters for seventy guests. This whole building is being placed at the disposal of the Club for the meeting. Members are asked to make reservations well in advance by writing to Mr. J. M. Nolte, 136 C. C. S. University of Minnesota, Minneapolis. Please mention the Wilson Club when writing, for space is being reserved for us that weekend.

A special committee, consisting of G. M. Sutton, Mrs. Ruth E. Lawrence, R. T. Peterson, and W. J. Breckenridge is arranging a large exhibit of bird art to be held in the University Art Gallery in Northrup Auditorium near the museum. There will be shown not only pictures by a large number of our present-day artists but also a number of representative works by noted artists of the past.

There will be the usual program of papers and members are requested to send the titles of the papers they wish to present to Dr. Pettingill on or before October 19. An important feature of the meeting will be a Symposium on Wildlife Management under the chairmanship of Professor Aldo Leopold.

At a reception in the Museum on Friday evening the study collections and library will be at the disposal of members, and a showing of motion pictures of birds will be held in the auditorium. There will also be an exhibit of some rare bird books incuding first editions of Audubon's double elephant folio, Wilson, Catesby's "Natural History," Swainson's "Fauna Boreali" from the Museum and other libraries of Minneapolis and Saint Paul.

On Sunday following the meeting there will be a field trip to the State Game Propagation Farm, thirty-five miles from Minneapolis. There will also be arranged sight-seeing tours to old Fort Snelling, the Mississippi and Minnesota Rivers, and other points of interest in the Twin City region.

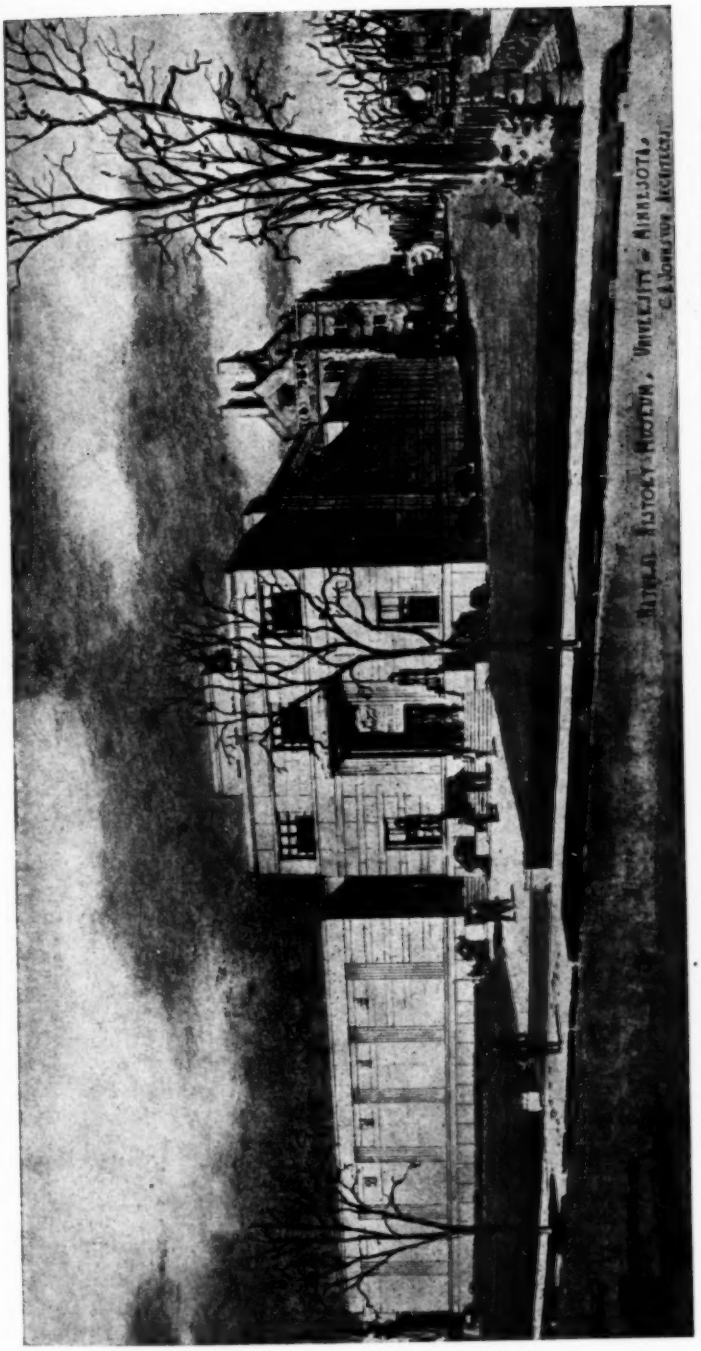
All indications point to a very enjoyable and stimulating meeting. Begin now and make your plans to be there. If you have never attended one of these meetings you can hardly realize how much you have been missing.

Some bird students like to keep a classified index to current publications in their special field of interest by pasting on card-index cards the printed references. If those interested will notify us we shall be glad to have extra copies of the *Bulletin's* lists of current papers printed on one side of the paper for such cutting and posting. If a number of people ask for this service it can be furnished at a very low cost.

OBITUARY

James H. Fleming, dean of Canadian ornithologists, died in Toronto on June 27. He was a profound scholar and knew world birds and the literature concerning them as few have ever done. His private collection of the birds of the world ranked high even among the great public collections in America. Mr. Fleming had been a member of the Wilson Ornithological Club for thirty-four years.

Arthur H. Howell, noted ornithologist and mammalogist, died in Washington, D.C., on July 10. He was the author of volumes on the birds of Alabama and of Florida and for the last two years had been editor of the Journal of Mammalogy.



University of Minnesota Museum of Natural History where our Annual Meeting will be held November 22 and 23.

WILDLIFE CONSERVATION

EDWARD K. LOVE FOUNDATION PROMOTES MISSOURI CONSERVATION. Some of the activities stimulated by grants from the Edward K. Love Foundation, established in December 1938 with a principal of $100,000, will be of interest to Wilson Club members. They are designed to fit into the program of the Conservation Commission, which has repeatedly emphasized the paramount importance of scientific research, natural production, and public participation.

For scientific research:

(1) Two $500 research fellowships at the University of Missouri, each with an additional allotment for travel-expense. The Foundation stipulates that one of these Fellows shall be engaged in the study of furbearers, the other in the study of some problem in aquatic biology. The former, Mr. Carl R. Noren, is studying limiting factors in the life-history of the raccoon; the latter, Mr. James R. Hurt, is beginning a survey of the distribution, ecology, and management of aquatic plants in Missouri.

(2) The Foundation has contributed $1,000 to the Commission, toward the expenses of an aquatic biologist, Dr. W. C. Frohne, who will be concerned with research and with the management of aquatic resources.

For natural production and public participation:

(3) County wildlife organizations:

In each quarter of Missouri, $200 in cash prizes, half for constructive work in the restoration of upland wildlife, half for similar efforts on behalf of aquatic and semi-aquatic wildlife. Artificial restocking is *not* included among these activities, which are outlined in the form of a dozen or more projects having as their obpective the improvement of native environment and increased public participation

(4) 4-H Clubs:

(a) Two $100 scholarships for the freshman year at the University of Missouri, for boys or girls who have made outstanding individual contributions along the lines just indicated.

(b) $100 in cash prizes for group activities of a similar nature.

(5) Future Farmers of America:

One $100 freshman scholarship at the University of Missouri and $200 in cash prizes.

(6) Other High-School conservation clubs:

$100 in cash prizes.

The first scholarship awards under (4) and (5) were made last summer. The first cash awards are to be made to all four groups in the spring of 1940. All awards are made on the basis of written reports, oral interviews, and field examination of the projects by field biologists of the Conservation Commission. The entire matter is in the hands of a central committee, with special committees supervising the several special activities.

DUCKS UNLIMITED. During the past ten years there have arisen two conservation organizations bearing similar names: "MORE GAME BIRDS" and "DUCKS UNLIMITED." The intent of these organizations has been freely criticized by *Nature Magazine* and by numerous workers in the conservation field. As is frequently the case, however, many of the critics have not been thoroughly acquainted with the personnel or accomplishments. This is not the place to review these organizations completely and we intend only to point out that such organizations frequently serve better than admitted by their critics.

The MORE GAME BIRDS organization certainly over-stressed "restocking and predator control," but they have contributed several bulletins useful to wildlife workers. DUCKS UNLIMITED, INC., (an out-growth of MORE GAME BIRDS activities)

is functioning in the United States to raise funds which are sent to DUCKS UNLIMITED, LTD., of Canada. The quality of field work, public contacts, and other activities of the Canadian work of DUCKS UNLIMITED seems to compare not unfavorably with that of well-known government agencies engaged in similar reconnoitering and restoration. It is not claimed by them that crows and droughts are the principal enemies of waterfowl; for they readily admit the seriousness of shooting. Any organization sincerely and intelligently working for waterfowl habitat restoration and public education in conservation affairs deserves tolerance and due appreciation, regardless of which side of our Canadian border the work is being done. Such organizations are no doubt benefiting from past experiences, as also are many of the state and federal agencies entrusted with wildlife affairs.

FEDERAL AID TO WILDLIFE. Under new projects Ohio and Connecticut are working on Ruffed Grouse, Virginia and Nebraska on the Quail, and Oregon is studying the Sage Grouse. Oregon, California, and Idaho are doing work with the beaver; Vermont is planning a survey of its fur animals, and Mississippi is undertaking a wildlife resources survey under the leadership of Miss Fannye Cook, biologist for the Commission. Many states, chiefly in the West, are undertaking deer management projects, and numerous states are acquiring new refuge areas.

WILDLIFE CONSERVATION COMMITTEE
Miles D. Pirnie, Chairman

ORNITHOLOGICAL NEWS

Dr. Alden H. Miller has been appointed Director of the Museum of Vertebrate Zoology, University of California.

Dr. Thomas S. Roberts was given the honorary degree of Doctor of Science by the University of Minnesota last June in recognition of his accomplishments in ornithology and his success in developing the Minnesota Museum of Natural History.

The Sixth Annual Midwest Wildlife Conference will be held in Urbana, Illinois on November 14 to 16. A special feature of the meeting will be the dedication of the new five-story Natural Resources Building on the University of Illinois campus.

The Department of Zoology of Carleton College has recently been given the North American bird egg collection of Alpheus Hewitt of Winnebago, Minnesota. This collection comprises 4,000 eggs, all with full data. The majority of the specimens were collected forty or fifty years ago and there are included therefore the eggs of many species which are now exceedingly rare.

The Fifty-eighth Annual Meeting of the American Ornithologists' Union was held at the New England Museum of Natural History in Boston and at the Institute of Geographical Exploration of Harvard University, September 9 to 12, with a registered attendance of 310.

Officers elected for the new year were as follows: President, James P. Chapin, New York City; Vice-Presidents, James L. Peters, Cambridge, Massachusetts, and George Willett, Los Angeles, California; Secretary, Lawrence E. Hicks, Columbus, Ohio; Treasurer, Rudyerd Boulton, Chicago, Illinois; Council, Ira N. Gabrielson, Washington, D.C., James Savage, Buffalo, New York, and J. Van Tyne, Ann Arbor, Michigan.

The Brewster Medal was awarded to James L. Peters for his "Check-list of Birds of the World."

Two Fellows were elected: Stanley G. Jewett, Portland, Oregon, and Robert T. Moore, Pasadena, California. In addition to 228 new Associate Members, 8 new Members were elected: Oliver L. Austin, M.D., Tuckahoe, N.Y.; Joseph J. Hickey, New York City; George H. Lowery, Baton Rouge, La.; Eugene E. Murphey, Augusta, Ga.; John R. Pemberton, Altadena, Calif.; Arlie W. Schorger, Madison, Wis.; Milton B. Trautman, Put-in-Bay, Ohio; and Lawrence H. Wilkinshaw, Battle Creek, Mich.

The 1940 meeting will be held in Denver.

ORNITHOLOGICAL LITERATURE [1]

CHECK-LIST OF BIRDS OF THE WORLD, Volume 4. By James Lee Peters. Harvard University Press, Cambridge, Mass., 1940: 6 x 9 in., xii + 291 pp. $4.00.

Volume 4 of Peters' Check-List, uniform in high standards of scholarship with its predecessors, treats the cuckoos, owls, goatsuckers, and swifts. It includes 114 genera, 464 species, and 1259 forms, and thus covers a smaller number of birds than any of the preceding volumes.

The tedious work of compilation is carried out in a thoroughly competent and accurate manner, but the Check-List is far from being a mere compilation. The author, with his wide knowledge of the literature and taxonomy of the class, has contributed a large amount of original matter in each volume. In many cases independent study of the more critical groups was made and resulted in the reclassification of entire families. Among the birds covered by the present volume, the owls had been particularly neglected, and the author's research in this family is especially welcome.

Surprisingly few of the North American birds included in this volume bear different names from those of the A. O. U. Check-List. Three genera, *Micrathene* Coues, *Aegolius* Kaup, and *Apus* Scopoli, are used in preference to *Micropallas*, *Cryptoglaux*, and *Micropus*, respectively, of the A. O. U. These changes are necessary under the "one-letter rule" of the International Rules of Zoological Nomenclature. The use of *Apus* unfortunately calls for a change in the A. O. U. subfamily, family, subordinal, and ordinal names for the group of swifts allied to "*Micropus*." Following certain European writers, Peters calls these Apodinae, Apodidae, Apodi, and Apodiformes, respectively. He has overlooked, however, Burmeister's much earlier use of the term Apodidae for a family of crustaceans. This name is still in current use among carcinologists. Burmeister's action precludes employing this term for the swifts and would seem to also preclude the use of its derivatives for ordinal, subordinal, or subfamily terms. One cannot use the terms Micropodidae or Cypselidae as the family name of the swifts, either, since these names are based on synonyms of *Apus*. Article 5 of the International Rules states: "The name of a family or subfamily is to be changed when the name of the type genus is changed." The best solution of this unhappy situation seems to be the erection of a new family name for the swifts, **Chaeturidae**, nom. nov., with *Chaetura* Stephens as the type genus. The suborder may be known as **Chaeturae**, nom. nov., and the order **Chaeturiformes**, nom. nov. A new subfamily term for the swifts allied to *Apus* is also required. These birds may be called **Panyptilinae**, nom. nov., with *Panyptila* Cabanis as type genus.

Peters uses *Bubo virginianus wapacuthu* (Gmelin), *Nyctea scandiaca* (Linnaeus), and *Strix varia georgica* Latham as earlier and applicable names for *B. v. subarcticus*, *N. nyctea*, and *S. v. alleni* of the A. O. U. List. Two genera recognized by the A. O. U., *Scotiaptex* and *Antrostomus*, are combined with *Strix* and *Caprimulgus*, and three forms of accidental occurrence in North America, *Cuculus optatus*, *Surnia ulula pallasi*, and *Scotiaptex nebulosa barbata*, are synonymized with other Old World forms. The Long-eared Owl is treated as a race of *Asio otus*. Seven subspecies of owls, most of them described since the publication of the latest edition of the A. O. U. Check-List, are accorded recognition by Peters, although one of them is said to be "doubtfully separable."

Although the text of the work is executed in a thoroughly reliable way, we find that in the introduction Mr. Peters has made a slip when comparing the increase of forms and decrease of recognized genera in the groups covered by Volume 1 of Sharpe's Hand-list. He gives the number of genera and forms in Volume 1 of Sharpe as 830 and 3626, respectively, apparently taking Sir Ray Lankester's count from the preface of Volume 2. He further states that the same groups in his own Check-List comprise 569 genera and 5106 forms, giving a

[1] For additional reviews see pages 172, 190, and 197.

decrease of 261 [31%] in the number of genera and an increase of 1480 [41%] in the number of species and subspecies recognized. All of these figures are incorrect.

In the first place, Sharp included fossil as well as recent species and genera, so it is not fair to compare his total figures with those of Peters, who gives only recent forms. According to my count, the total number of recent genera included in Volume 1 of Sharpe is 741; of forms 3303. These figures include recently extinct species, which Sharpe gives in antique type like the fossil ones. The total number listed by Peters for the same groups is 662 and 5127 forms, by careful count. This is a decrease of only 79 genera (11%), and an increase of 1824 forms (55%). Broken down to Orders, a comparison of the two lists is as follows:

	Genera			Species		Forms	
Order	Sharpe	Peters	Change	Peters	Sharpe	Peters	Change
Struthioniformes	1	1	0	1	4	6	+2
Rheiformes	1	2	+1	2	3	6	+3
Casuariiformes	2	2	0	8	16	35	+19
Apterygiformes	1	1	0	3	6	5	—1
Tinamiformes	9	9	0	51	69	118	+49
Sphenisciformes	6	6	0	17	17	22	+5
Gaviiformes	1	1	0	4	5	8	+3
Colymbiformes	7	5	—2	18	25	39	+14
Procellariiformes	25	24	—1	107	121	187	+66
Pelecaniformes	8	9	+1	59	77	126	+49
Ciconiiformes	73	58	—15	124	168	244	+76
Anseriformes	73*	64	—9	170	210*	231	+21
Falconiformes	92	89	—3	289	515	701	+186
Galliformes	95	94	—1	276	476	830	+354
Gruiformes	84	81	—3	205	303	482	+179
Charadriiformes	139	124	—15	315	412	604	+192
Columbiformes	94	63	—31	326	560	889	+329
Strigiformes	30	29	—1	143	316	594	+278
Total	741	662	—79	2118	3303	5127	1824

* Includes "Palamedeidae" omitted by mistake from Volume 1 of Sharpe.

With the completion of Volume 4, Peters has now covered about half (82) of the 165 families of birds. His work is far from being half completed, however, since he has published on only one-third (838) of the estimated 2600 genera, one-third (2783) of the 8500 species, and one-fourth (6570) of the 27,000 described forms of birds. It therefore seems that the estimate of ten volumes needed to cover all the birds of the world will have to be revised upwards to sixteen, even without allowing for the annual increase of some 200 valid described forms. At the present rate of one volume every three years, we must wait until Mr. Peters' eighty-seventh birthday in 1976 to see the Check-List finished.—P. Brodkorb.

BIRDS OF WESTERN PENNSYLVANIA. By W. E. Clyde Todd. University of Pittsburgh Press, 1940: 8½ x 11 in., xv + 710 pp., one black and white and 22 colored pls., folding map. $5.00.

We welcome the publication of Mr. Todd's long-anticipated "Birds of Western Pennsylvania." The introductory sections of this book include accounts of the geography and ornithological history of the area, the author's own field work, and the general features of bird distribution. The author's early training in the U. S. Biological Survey is probably reflected in his decision to use the "Life-zone" concept in his discussion of bird distribution. It is, however, incongruous to find

a rather detailed account of bird distribution by life-zones concluded by the statement that "the attempt to express these faunal differences in terms of the current life-zone divisions is unsatisfactory and confusing" and to read (p. 8) that "Zoologists and botanists . . . have found it unacceptable and unworkable." If so, what significance is there in these pages about Pennsylvania life-zones? One strange statement made in this connection, which we cannot let pass unchallenged is the author's assumption (p. 8) that ornithologists are not zoologists. Most of us would define ornithologists as fortunate zoologists who are using the Class Aves as a medium for the study of zoological problems.

As one would expect in a work produced by Mr. Todd, this book is exceptionally well proof-read and checked. The only typographical error we have found is the citing (p. 496) of volume 2 instead of volume 3 of Forbush's "Birds of Massachusetts." Among ornithological errors we note a repetition of the old beliefs that the Cowbird's incubation period is only 10 days and the Spotted Sandpiper's 15 days, and that the Black-capped Chickadee does not migrate.

It is surprising to find one of Mr. Todd's reputation including in his book so many species whose occurrence is based only on rather questionable sight records. In this category we would place the Louisiana Heron, Iceland Gull, Franklin Gull, Little Gull, Canada Jay, Hoary Redpoll, and Lark Bunting.

The complete accounts of the habits of more than 25 species are contributed by others. These co-authors include B. H. Christy, Ruth Trimble, E. W. Arthur, T. D. Burleigh, and seven other observers.

For the most part the accounts of habits are excellently done but occasionally there appear bits of sentimentalizing or humanizing that are very out of place in a scientific book. For example, no scientist should ever be guilty of writing about a bird's "brazen pride" or "villainous habits" or "merry disposition." Birds are not little humans and a scientist is not increasing knowledge among men by writing as though they were. It is only fair to state that most of these lapses are to be found in the accounts of bird habits contributed by other writers, but the responsibility for their appearance here remains the author's.

We find it hard to understand the author's use of a number of scientific names, which he himself states unequivocally are incorrect, simply because they were used in the 1931 A.O.U. Check-list. The perpetuation of error for the sake of standardization is certainly not the best scientific procedure.

There may be some system behind the author's capitalization of English proper names of bird species but we have failed to fathom it. On some pages he has capitalized consistently but others seem to be an indescriminate mixture of capitalized and uncapitalized names.

We frankly do not believe the story the author quotes of the Killdeer that put the squad of young Killdeers through close-order drill and we are discouraged to read again in 1940 of the "ruse" employed by the "resourceful" Yellow Warbler to combat the interloping Cowbird. Another questionable suggestion is that the extra nests built or started by Red-wings are perhaps meant as a provision "against peering eyes or prying hands."

The precise distribution of many species is shown by excellent "spot maps"—not the misleading, old-fashioned type of map in which the author draws in a solid distribution zone in which he thinks the species must surely occur. We only wish that the symbols for individual records had been made somewhat larger. In some cases (as p. 393) the maps require very close inspection to be understood.

The volume is handsomely illustrated with a large number of very effective bird portraits by George Miksch Sutton. Many of the pictures are as fine bird portraits as have ever been published. One hundred and eighteen of these pictures are in color and are arranged in a novel and very successful manner whereby all of the birds are reproduced in proportionate size and with but one (in a single case, two) species in a picture. Two to nine of these pictures are repro-

duced on a page, all explanatory text being conveniently placed in corresponding rectangles on the opposite page. The artist has thus avoided the Swiss-family-Robinson groupings forced on many painters by the necessity of showing many species on one plate. The reproduction of a few of the plates in the copies we have seen leaves something to be desired but most are excellent.

This book is unusual among modern bird books in that no photographs have been used as illustrations.

"The Birds of Western Pennsylvania" concludes with an admirable gazetteer of 921 entries, a thoroughly annotated bibliography, and a good index. A new feature of this book is the multiple repetition of a large proportion of the references in separate bibliographies at the close of each species account. It is certainly a convenience to have these, but the repetition of the complete references and even some annotations has added unnecessarily to the bulk of the volume.

We hope that our several criticisms of minor points will not cause anyone to miss the fact that this is one of the most scholarly, useful, and attractive state bird books yet published.—J. Van Tyne.

The Birds of Buckeye Lake, Ohio. By Milton B. Trautman. Univ. of Michigan Museum of Zoology Miscellaneous Publications No. 44, May 7, 1940:1–466, 16 pls., 2 maps, $2.50.

The value of any science lies not so much in its discoveries as in the number of minds which participate in its development.

In Audubon's day the cost of participation in ornithology was exile at the physical frontier. During the ensuing century the theatre of activity moved gradually inward until Margaret Nice proved, in 1937, that any layman can find an ornithological frontier in his (or her) own backyard.

The Nician explorations, however, call for the continuous use of precise ecological techniques such as banding, and a command of the latest researches in avian psychology. To this extent the rank and file are still in the status of admirers of pioneering, rather than pioneers.

The significance of Milton B. Trautman's "Birds of Buckeye Lake" lies in the fact that it explores the ornithology of a "backyard" region with the help of ecological thinking and observation alone, i.e., without the use of precision techniques. Hence "Birds of Buckeye Lake" is something any ornithologist can do in his own region, given only the persistence, imagination, and field skill of Milton B. Trautman.

To me there is something comfortable in this. I admire and emulate the Nician techniques, but I love old-fashioned acumen in the field, and I welcome Trautman's proof of how good a job it can do.

Like Murphy's "Oceanic Birds," Trautman's volume is outstanding not alone for its life histories of species, but especially for its introductory analysis of the region in which they live. Many local works on birds contain an introductory description of the locale, but most such descriptions are lame indeed compared with Trautman's rich history of central Ohio. Geographers, historians, and agronomists can afford to own Trautman's work for its history alone. Ecologists in particular can glean new wisdom from his skillful interpretation of the retrogression of soils, waters, floras, and faunas since the days of first settlement.

The early history of Buckeye Lake is compiled from other authors and old settlers, but since 1906 Trautman has been eye-witness to the local pageant. His intensive studies cover the period 1922–1934, during which time 541 days were spent in the field.

Several of Trautman's methods of study are original. No other ornithologist has followed groups of migrants cross-country by car to note their social organization en route. No other ornithologist has recorded in such detail the characteristic flock formations and behaviors of arriving and departing waterfowl (and few

other lakes lend themselves as well to such studies as does Buckeye). Few other ornithologists know their fishes, mammals, and plants as well as their birds. Trautman's graphic month-by-month record of changes in distribution and abundance is hardly original, but I recall no other author who has applied it to so many species.

So ambitious an undertaking could hardly be wholly free of slips and foibles. Thus Trautman, like the Audubon Society, calls a species list with numbers seen a "census." I prefer to reserve the term "census" for an actual enumeration of the birds present on a given area.

Not the least merit of Trautman's volume is its simplicity and clarity. The reader is never befuddled, nor is he forced to swallow any needless ecological jargon. (One might even conclude that the absence of such jargon is becoming an earmark of ecological competence. The works of Charles Elton, Fraser Darling, and Margaret Nice would likewise support such a view.)

A good bibliography and index add much to the reader's convenience in using "Birds of Buckeye Lake," and a series of excellent photographs add to his pleasure in owning it.

I am puzzled by just one thing: Why did Ohio let Michigan bring out the Trautman volume? The average reader, however, will content himself with being grateful that somebody brought it out.—Aldo Leopold.

A Book on Duck Shooting. By Van Campen Heilner. Penn Publishing Co., Philadelphia, 1939: 6¼ x 9 in., xiii + 540 pp., 16 color pls., 235 photos, many drawings. $7.50.

This is one of the best duck hunters' books we have seen and holds much of interest for the ornithologist as well. The first 250 pages are devoted to some most entertaining essays on the author's duck hunting experiences in many parts of the world. The essays are very well done but, as the author says, the most valuable part of this book is the appendix, which includes chapters on flight speeds of birds (by May Thacher Cooke), waterfowl flyways (by F. C. Lincoln), modern decoys (by Joel Barber), boats and blinds (by H. L. Betten), sunspots and cycles of abundance in waterfowl (by Ralph De Lury), marshes of the past and future (by Clarence Cottam and Warren S. Bourn), and duck clubs. The final section is a "Guide for Duck Shooters," consisting of small scale drawings of the American species of waterfowl, their scientific names, and their geographical ranges.

Eleven species of ducks and seven of geese are shown in the color plates and a number of others are shown nearly as well in the many excellent drawings, all by Lynn Bogue Hunt. The pictures are admirable and their reproduction good but, unfortunately, they are often very inadequately labeled. For example, a fine colored plate of the three American species of scoters is labeled "Coot Shooting in New England." Other pictures have the name of only one of two or more species figured.

The so-called bibliography at the end of the book is so brief as to be almost useless. Only 28 titles are listed and all data beyond the bare mention of author and title is omitted.

The book is handsomely printed and does great credit to both author and publisher.—J. Van Tyne.

A Manual of Aquatic Plants. By Norman C. Fassett. McGraw-Hill Book Co., New York, 1940:6 x 9 in., vii + 382 pp., many illustrations. $4.00.

To date a problem in connection with writings on the utilization and management of waterfowl food plants has been adequate treatment of identification within the space limits practicable in economic publications. That problem may

now be dismissed and readers referred to Dr. Fassett's excellent work which deals primarily with recognition of the plants. Through cooperative effort the book has been copiously illustrated and as the author says "The text is essentially a set of directions for looking at the pictures." The work consists chiefly of keys fully correlated with the illustrations and intended to permit determination of plants even in sterile condition. Generalized descriptions and succinct references to supplementary recent publications on the groups of plants also are given.

The ornithological material is concentrated in a chapter summarizing knowledge on use of the plants by birds and mammals, that is accompanied by an index to the notes by species and other groups, and a bibliography (of 95 items) of the sources of information. Data on fishes is similarly treated. There is a glossary of technical terms and a full index. A much needed and well executed manual.—W. L. McAtee.

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